THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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DEPARTMENTAL DECISIONS.

A CASE of the utmost importance to those who have to do with Government Departments was decided last week by the Court of Appeal. It primarily concerned the Local Government Board; but the decision is of such a nature that it must necessarily affect the dealings of the Board of Trade and other Government Departments.

It has been the fashion in recent years for the Legislature to withdraw all recent Acts of Parliament from the jurisdiction of the Courts. A new tribunal for the settlement of difficulties is frequently set up; but if not, it is declared that disputes "shall be settled by some one or other of the existing Government Departments." This form of inquiry may or may not be acceptable to the public; but so far as Officialdom is concerned, it has the advantage of secrecy. The case decided last week bids fair to raise the curtain to some extent.

The material facts were short and simple. A house was declared unfit for human habitation by an inspector appointed under the Housing and Town Planning Act. This was after two public inquiries, at which the householder gave evidence. The inspector made a report to the local authority who, in their turn, made the closing order.

Thereupon the house-owner appealed, as he was entitled to do, to the Local Government Board. Before his appeal came on for hearing, however, he was informed that the matter had been considered by the Board or some person properly appointed, who, acting on the information in the report of the inspector, had decided to dismiss the appeal and confirm the order. The householder took exception to this and took certain legal steps, as a result of which the Court of Appeal has quashed the order. Lord Justice Vaughan Williams pointed out in effect that the procedure adopted by the Local Government Board was contrary to natural justice.

Lord Justice Buckley said:—

> I am opposed to the growing tendency of Government Departments to regard as privileged reports made to them on matters which affect the rights of the individual . . . . . I am strongly of opinion that the appellant was entitled before such an order was made to be put in possession of the facts alleged against him on which the Local Government Board acted, and was entitled to an opportunity of upsetting them if he could. If the appellant had a right to be heard on appeal to the Local Government Board—he certainly has the right to appeal—it is no answer to say that he has been heard before the Inspector. I think the appeal must succeed on that ground, and the closing order be quashed. A decision of a Government Department is like the judgment of a Court. Not only must the proceedings be openly conducted, but the Judge cannot give judgment with closed doors.

It is true that Lord Justice Hamilton dissented from the rest of the Court, but we cannot refrain from expressing our satisfaction at the result of the proceedings to date.

The practice of the Local Government Board is similar to that of other Government Departments, to each of which quasi-judicial functions are constantly being assigned by new Acts of Parliament.

For our part, we hope that this decision will be borne in mind by the Board of Trade when exercising its jurisdiction under the Electric Lighting Acts. An appeal lies to that Board in certain cases. Thus, as our readers are aware, where the exercise of powers under the Electric Lighting Act involves placing works in streets, notices have to be given to the local authority and the Postmaster-General. The local authority or the Postmaster may disapprove of the proposed works, and if the undertakers wish to go further their remedy is to appeal to the Board of Trade. An appeal is also allowed to the Board of Trade where there is a dispute between an undertaker and a consumer as to a requisition made by a consumer.

Again, the Board of Trade Regulations provide by Paragraph B (4) that the system and frequency of the supply shall be maintained subject, as respects frequency, to a variation not exceeding 2½ per cent. above or below the declared frequency, and shall not be altered or departed from except by consent of the Board of Trade, and upon such terms and conditions as the Board of Trade may impose. To mention in detail the matters with regard to which the Board has power to give or withhold consent would be beyond the limits of our space. Suffice it that consent may be required for the breaking-up of private streets; the construction of the generating stations; overhead wires; supply for traction purposes; transfer of rights of purchase. Finally, to mention a power but recently conferred upon the Board, Sec. 6 of the Electric Lighting Act, 1909, makes provision for the supply of electricity from area A to premises within area B, subject to the consent of the undertakers in area A. "Provided that, if, in the opinion of the Board of Trade, any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given."

We have said enough to show the extent to which those interested in the supply of electricity are subject to the jurisdiction of the Board of Trade. And there is no appeal. In the instance last cited the Board may declare that consent has been unreasonably withheld, but no one other than a few clerks in a Government office ever knows why. The judgment in the matter may be perfectly capricious, but it is absolutely final!

It is for this reason that the electrical world will be glad to see the ruling of the Court of Appeal as regards the Local Government Board applied to other Government departments. Too great has been the tendency in recent years to subject large questions which closely concern the public to hole-and-corner official inquiry. A matter of enormous moment to a large body of shareholders or ratepayers may be subjected to the decision of a third-rate official who is sheltered for all time behind the magic name "Board of Trade," and whose reasons, however wise or foolish, are never submitted to the ordeal of public opinion.

Quantitative and Qualitative Heating.

Much error creeps into matters of engineering and manufacture from the failure to perceive that the utility of heat is not to be measured by temperature alone or by calories alone. Nobody will deny that in producing electricity by means of coal-generated power only a very small fraction of the calorific capacity of the coal can be ultimately reproduced as heat by using electricity as the go-between. That this is not due to any fault in electricity is plain to be seen from the high coefficient of conversion of water power into electrically-generated heat. Briefly, the conversion of mechanical energy into electricity is a process of high efficiency, and so is the process of turning electrical energy into heat energy; but to convert heat into work is a process of low efficiency. Yet there are small operations demanding heat, which can be carried out by electrical means with commercial economy even in competition with heat generated direct from fuel.

An example of this is the cooking of food. To cook food it is necessary to heat it to a certain fairly high temperature. Assume this to be 150° F. above atmospheric temperature, and that the food to be dealt with weighs 7 lb. Assume this mass even to be as water in possessing a specific heat of unity, then it will require 1,050 units of heat to raise the food to the desired temperature. This is equal to the heat in $\frac{1}{14}$th of a lb. of good coal. Electrically it is equal to about 0·3 KW.-hour or to about 1 lb. of coal burned in the power-producing boiler. But by means of careful heat insulation the electrically generated heat has been so conserved that it has become possible to conduct cooking operations with much less heat than is *ordinarily used* by direct fuel cookery. There is great difficulty in burning solid fuel in such small quantities as will enable the same economy to be secured. Gaseous fuel labours under the necessity of maintaining a constant stream of hot gases.

The electric cooker aims to attain to a high temperature, and not to lose heat by convection, conduction or radiation—all which losses are unavoidable in other methods.

Makers of steam superheaters have attempted to temper the furnace heat to the superheater pipes by a flood of cold air, which simply means that they waste heat by reducing it below a usable temperature. The correct method is to absorb the surplus heat in some previous useful operation, so that the hot gases may be turned into the superheater at a safe temperature, and after use there, still serve for feed heating. Superheating is a quantitative operation, for it requires much heat, but not at a maximum temperature.

Domestic water heating requires heat in quantity. A 40-gallon hot bath demands at least 20,000 heat units, or, say, 6 units of electricity, costing 18 to 30 lb. of coal. Similarly for heating a house, heat is required in quantity, and must not be confused with the occasional use of an electric heater to take the chill off a small room. The quantitative demands for heat have been badly catered for by solid or gaseous fuels, because it has been the habit to maintain a current of heated air, and only to use a small fraction of the heat by way of radiation, instead of by other means. What is to be borne in mind in questions of heating is the essential difference between degrees and calories, between the process which consists in heating a small quantity of stuff and keeping it hot, and the heating of a large mass of stuff, which must travel away from the locus of heat application. Cooking exemplifies the first, as also should crucible heating, if the above principles received better attention. The second is exemplified in the heating of air or water to be applied to house warming, for the heat is of necessity sent continually to waste by the process of ventilation, and is of such low temperature quality as to be past use as a waste product.

The Future of Municipal Enterprise.

We commend to the study of all of our readers who are interested in the subject of municipal *v.* private ownership, some extracts from a very important report by Sir F. Oppenheimer (H.M. Commercial Attaché for Germany), which appear on another page of this issue.

The co-operative control movement that has been in progress in Germany for some time past has been described in our pages. Changing opinion in that country has brought about a strong feeling in favour of a combined system in which private companies are responsible for the management of electrical undertakings, the municipality participating in the capital and having a voice in the said management. Municipal authorities find that municipal operation is too inelastic to enable it to adapt itself to modern and changing trade and industrial conditions. A score of other reasons are given explaining the desire for a change, and so many of these have been discussed in our pages in relation to British affairs, indeed, are brought into evidence almost weekly in our electric supply and traction news, that we find it difficult to resist the temptation to make a detailed commentary on this report considered from the British standpoint. We will, however, omit the detail at the moment, and confine our attention to main principles.

There are, of course, differences between the conditions, legislative, local, and probably industrial as well, obtaining in the United Kingdom and in Germany, but we cannot feel, democratic as the times appear to be, that the municipal control spirit is going to continue unmodified in perpetuity here. Though the signs are not very pronounced, we believe

the time is not far distant when the inherent weaknesses of public ownership will lead to agitation for a change. We say this not because of antagonism to such a policy, nor because of any predilection we may be assumed to have for private enterprise, and still less with any desire to reflect upon electrical officials personally, but purely for the reason that when the demand for efficiency everywhere, whether in man or machine, is so strong, the weaknesses which are inseparable from a purely municipal system, unless it be under the control of a strong man who knows what is best, and can command it both from the Council and from its employés, must inevitably receive attention.

Everybody will agree that the average councillor is quite incompetent to *control* public gas, electrical and other such undertakings with knowledge. This being so, what exists to-day may be municipal ownership without municipal *control* except that poor sort of authority that a councillor exercises when sheer necessity compels him to vote one way or the other. The technical official and his small committee are the municipal board of directors, but they have to ask approval from the general body of councillors who do not know what they are voting upon. Of course there is, as a general rule, an assurance that the technical official will not go very far wrong technically, because, in a very important sense, he does not stand alone, having at his disposal the experience and opinion of the hundreds of other like officials engaged in other cities and towns. But our present point is that when the Council does actually control it often goes wrong, whereas at other times, by reason of its sheer inability to comprehend, it must blindly follow the leading of its technical official. As matters stand, we, of all men, should not quarrel with the latter course, but it is as well, when the broad principles are under discussion, that the people who comfort themselves with the thought that certain public works are their very own properties should recognise how very small is the measure of control exercised by those whom they elect as their representatives. Sometimes busybody councillors intervene and make big blunders, and technical men ask for more freedom from pettifogging interference. But is it not the system rather than the councillor that is at fault? We should like Sir F. Oppenheimer's report to be made the basis of a calm and dispassionate discussion by quite unbiased men, for a number of the weaknesses summarised therein in relation to the German position have arisen in many places in the United Kingdom. Maybe other observers among our readers may agree with us that the future seems likely to bring about more of that co-operation, financial and otherwise, of British companies and municipalities, toward which Germany seems to be inclining, and of which there is at least one important working example within a few miles of North London. The hostility of municipalities toward companies in some of the big industrial areas has, we believe, almost died out as the problems of electrical development have worked their way home to local minds. In this there is both cause for gratification and a sign of the coming tendency. The lion and the lamb may yet fraternise, and the general public and the capitalist find it to be of benefit to both to co-operate in providing and controlling electrical facilities.

Special Courts for Patent Cases.

In the *Times* of October 12th there appeared a letter from a barrister, in which a plea was urged for the establishment of special Courts for the hearing of patent actions. Many of the old arguments were brought forward in support of the proposal. Under the present system patent cases are tried indiscriminately by the Chancery Judges, and the result is that in patent matters the rule is *quot homines, tot sententiæ!*

The chief objections raised in the letter above-mentioned are that patent cases, being long, interfere with the administration of justice for other litigants. It is urged that if the patent case could be sent to a separate Court, duels between counsel and expert witnesses could be fought out *ad nauseam* without incommoding others of His Majesty's subjects seeking justice in the Courts. Finally, it is pointed out that at present appeals from the decisions of the Comptroller of the Patent Office as to granting patents, &c., are now heard by the Solicitor-General, whose time is so fully occupied otherwise, that very often a year elapses before he can take up the Patent Office business. During this time the applicant has to wait—in doubt whether he will obtain his patent or not.

It is suggested that the jurisdiction of the Solicitor-General might well be transferred to the new Court, where patent cases were a speciality.

To advocate some measure of reform in the present system under which patent and other technical cases are tried is no new thing. The difficulty is to know where and how to begin. The word patent, to adopt the comprehensive phrase of Count Smorltork, "of himself comprises a study of no inconsiderable magnitude." It would require an encyclopædia to enumerate the different scientific questions which may have to be decided in patent cases; and to secure the services of a single man who possessed the necessary knowledge would be almost impossible. Indeed, it is hard to know where to find one well equipped with the faculties of a good patent judge except within the ranks of the legal profession. But, alas! it is not from the ranks of those who specialise in patent cases that the Judges are appointed. They are men who have distinguished themselves at the Chancery Bar. With one notable exception, all the gentlemen raised to the Bench in recent years have had but little experience in patent cases. The exception, of course, is Mr. Justice Astbury; but he had professional claims of a high order, in addition to his practice in patent cases. It will be remembered that an effort has been made to bring certain kinds of patent cases to one Court, or before one Judge. There is one Judge to whom all the cases arising under the Compulsory Working Clause are specially assigned; and in so far as he has been employed in this kind of duty, his work has given satisfaction. An attempt might be made in the required direction by extending his jurisdiction to regular patent cases.

It is essential in these matters to proceed slowly and tentatively. The legal machine appears to the layman to be cumbersome and out of date; but it has been evolved by centuries of experience. If one of its varied movements is disarranged, others must inevitably be affected. If one man were told off to try patent cases he might always give satisfaction to patentees, and but seldom favour infringers, and this through no bias or "cussedness," but from a warp in his judgment. It is no uncommon failing in the judicial mind. Thus there are certain County Court Judges who, when deciding compensation cases, nearly always find for the workman. In the result, the employer keeps away from their Courts. But the "infringer" would have no way of avoiding trial before the Patent Judge. Having regard to this one consideration, it would seem better to distribute the trials of patent cases among many Judges rather than to restrict them to a few.

The "Tynemount."

The new electrically-driven cargo ship *Tynemount*, which we describe and illustrate in this issue, takes us one step further towards the electrical engineer's ideal in marine engineering.

Unfortunately this first British-built electrically-propelled vessel for commercial use falls short of the ideal, in that its deck machinery—cargo winches, steering gear, &c.—is steam driven, and therefore probably no better, if no worse, than the deck equipments of the great majority of cargo vessels, which even marine engineers admit are steam eaters.

While there is no doubt some substantial reason for the arrangement adopted in this case, we may be pardoned for regretting that the examples of the *Selandia*, *Jutlandia*, with their all-electric deck machinery, the *Fauvette*, and of the many large ocean liners which have most extensive deck electrical equipments, have not been followed.

Meanwhile, the behaviour of the *Tynemount* will be watched with close interest by the shipping fraternity, who, once convinced that electric propulsion, whether on the Mavor system, as employed in this case, or on any other, is commercially advantageous, will not be slow to adopt it.

The Drying and Purifying of Insulating Oils.

In spite of the improved chemical and physical properties of modern insulating oils as used in transformers, oil-break switches, lightning arresters, condensers, &c., it is almost impossible to prevent the admixture of water either in transport or in service. Moreover, leakages may occur in the oil tanks or the cooling coils, allowing water to mix with the oil, while another source of deterioration is to be found in the carbonising of oil particles at the contacts.

The presence of water in insulating oils is more dangerous than is usually supposed, it having been proved that even ·005 per cent. "humidity" considerably reduces their insulating properties. This fact was probably first realised by cable makers, who use considerable quantities of oil in the manufacture of paper cables. The oils used in impregnating the paper are, therefore, dried by filtration through a screen of calcium chloride. Oils used for lubricating the cable during its manufacture are also similarly treated, while the vaseline or solidified oil, which plays such an important part in paper cable manufacture, is warmed to give fluidity, and then dried by filtration in the same manner.

An interesting process of oil filtration under pressure is described in *L'Industrie Electrique*. The theory underlying this process is that not only are any solid particles mechanically separated, but all moisture is retained on the filter screens by capillary attraction. A motor-driven pump causes the oil to flow through a fine mesh metal strainer (which arrests all the larger solid particles) into a series of filter chambers. Each chamber consists of a cast-metal plate and a metal frame, on which is stretched absorbent paper. The plates have projections on their surfaces, which support the filter paper and allow the oil to circulate. The whole series are clamped together between two stout end-plates, while an emergency valve is fitted which allows free passage of the oil in case the pressure in the filter becomes so great as to threaten rupture of the papers. This occurs when the oil is so impure as to clog the filter pores.

Filter presses in actual use will deal with 10-15 litres per hour and 45-50 litres per hour. It is recommended that after cleaning, the filter papers be dried in a special form of electric oven. This is a porcelain stove fitted with regulating dampers; the heating elements are metal strips encased in pure mica and enclosed in steel tubes, which fit into bayonet sockets in the oven.

Mr. H. H. Hodgman, in the *General Electric Review*, discusses the necessity for this process, and gives interesting suggestions as to the nature of the samples to be tested before deciding on the filtration. He states that after standing 24 hours the humid and impure oil will be found at the bottom of the tank, and should be extracted for examination by the aid of an improvised pipette. This is a glass tube 1 in. in diameter, but drawn out to one-quarter its original diameter, and long enough to reach the bottom of the tank. The palm of the hand is placed over the larger end, and the tube is passed to the bottom of the tank; on removing the hand the tube fills with the lower strata of oil, and on replacing the hand this sample can be drawn out.

When examining large transformers or other reservoirs of oil, at least 20 litres of oil should be drawn out at first, in order to cause a circulation of the oil through all portions where water of condensation might collect. All tubes and vessels used during the test must be very carefully cleaned and dried, and precautions must be taken against the action of a humid atmosphere while testing.

Before filling a transformer tank, the oil should certainly be filtered, and before placing the transformer in commission, the oil should be allowed to stand several hours; at the end of this period samples should be drawn off as described, and if found "wet," the oil should be drawn off and refiltered.

A SUGGESTION TO THE ELECTRICAL MANUFACTURER.

[COMMUNICATED.]

Manufacturers have long recognised that while it is true that quality speaks for itself, still it is necessary to provide the audience, and the art of advertising has never been so highly developed as at the present time. In the electrical industry especially, progress has been so rapid and improvements so numerous that consumers are, to a great extent, dependent on a vigorous publicity campaign to keep them posted up in the latest applications of electricity.

Many of the larger manufacturers, realising the importance of making their products known, have established publicity departments which issue really valuable information illustrating their products with well-made blocks and giving valuable working data; this is a move in the right direction, but they do not seem to go far enough, and the following experience may perhaps illustrate what the writer means.

A number of lantern slides were required to illustrate the applications of electricity to machine tools for a lecture before an engineering society, so a number of prominent firms who make a special line of this class of work, were asked if they could assist with illustrations, and the response was most gratifying. Not only good reproductions, but photographic prints, were freely placed at the lecturer's disposal, and in addition a great deal of valuable information was supplied which was very useful in the preparation of the paper. What seemed strange was the fact that practically none of these firms had lantern slides of their illustrations; each of them must have had one or two members of their staff who were good photographic workers for the prints sent were splendid specimens of the photographic art, and in many cases each print would cost twice as much as a lantern slide of the same subject. Now, during each year these firms must get many requests for illustrations and information, and on each occasion they would send out prints which are converted into lantern slides. The charge for making a slide from a print amounts to 1s.; for, first of all, a negative must be made, and then a slide is made from it; a second slide would only cost another 6d., for, of course, the negative can be used for making any number of slides. If the firms who send out photos for this purpose were to obtain a lantern slide of each print used, they would form the nucleus of a collection which could be loaned to others, carriage, of course, being paid both ways by the user; but it would pay a firm to lay themselves out to make a complete set of lantern slides of their productions and make it known that these would be loaned to lecturers, to technical schools, and to engineering or scientific societies.

The actual cost of a set of about 40 slides is well within £1. The name of the firm would of course be printed on the slide, so that a larger public would be reached than by means of prints; besides, many slides used in lectures are made by people who are not accustomed to lantern slide work, and they do not do justice to the originals.

One or two small albums filled with prints taken from the same negatives as the slides, and numbered to correspond with them, should be made, and these would be sent to the applicants when selecting slides, thus preventing unsuitable ones from being forwarded. The usual rate for the hire of lantern slides is 6d. per dozen per night, and at this price the scheme could be made self-supporting, an unusual thing in publicity work.

When one considers how a lecture before an engineering society attracts the very people before whom the manufacturer wishes to display his goods, it is surprising that this branch of publicity work has been so long neglected.

Engineering is one of the principal industries of the kingdom; in every large town in manufacturing districts there are engineering schools, engineering or scientific societies, and in almost every case the complaint of secretaries and committees is dearth of papers; here is a chance for manufacturers to step in and help themselves, as well as do a kindness to those who will be, and sometimes are, in a position to benefit them. Let them make up illustrated lectures, which, while they advertise their plant, will still be interesting and instructive to the audience. Subjects for such lectures will readily suggest themselves; for example,

"the making of a dynamo," could be well illustrated by photographs showing the various stages and processes of manufacture, also examples of the firm's work and interesting cases of the applications of the machines.

Throughout the lecture attention could be drawn to the outstanding features of the design, with comparative illustrations showing how other people achieve the same ends. If desired, and if illustrations are available, the evolution of the dynamo can be traced, also emphasising how near to perfection the firm whose goods are shown has brought designs.

The same thing could be done for other electrical apparatus or groups of manufactures, such as switchboard instruments, &c. Another style of lecture, which would appeal not only to students or popular audiences, but also to works managers or publicity departments of supply undertakings, would be a paper on, say, the applications of motors to various industries; a firm of motor manufacturers has unique opportunities for collecting illustrations on such a subject, and as slides accumulate the lecture can be rewritten to deal with special industries, such as "Applications of motors in shipyards," "applications of motors in sugar refineries," "applications of motors in breweries," &c. By adding a popular account of how sugar is refined or how brewing is carried on, the lecture can be made to appeal to a still wider audience.

A third type of lecture to deal with the commercial side of the applications of electricity would be very popular with some audiences; comparative tables, curves and charts taken from recording instruments and diagrams would be interspersed with photographs of machinery and examples of methods of driving.

A lesson could be learnt from photographic material manufacturers who not only prepare popular lectures to advertise their goods, but also send lecturers and demonstrators free of charge to photographic societies all over the country. The fact that such lectures are multiplying is conclusive proof that the promoters are finding that it pays, while the experience of the societies is that these trade lectures are among the best attended meetings of the whole session, for no effort has been spared to make them attractive.

Electrical firms who would follow suit are not called upon to make radical departures from their usual practice. They have all the data necessary, and in most cases they have all the illustrations also; it is merely a question of getting a member of their staff, or even an outside man, to write up a suitable lecture and getting their photographer to make up a set of their photographs in lantern slide form. The electrical papers would probably be willing, like the photographic journals, to publish the names of firms who have illustrated lectures or lantern slides for loan or hire purposes, and thus enable the secretaries of engineering societies to get into touch with those who are willing to help.

When it is known what firms stock slides of their machinery and apparatus, they are sure to receive photographs from their customers showing their plant in operation under various conditions, and the most interesting of these could be secured for publicity purposes.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Batteries for Telephones.

I am a storage battery maker, and frequently quote and obtain orders for batteries for telephone exchanges. Some of the makers of telephones require one to state the internal resistance of the cells offered, and I should very much like to know what difference this makes. I am not a telephone expert, but I am very sceptical as to whether the internal resistance matters a scrap, particularly as some purchasers of telephone batteries do not raise the question.

I beg to hereby give formal notice that if the telephone makers do not enlighten me, I shall regard it as proof that I am right and they are wrong.

E = C R.

Remarkable Motor Records.

Your recent article on the above subject should surely interest all designers, and I think a great many will be at one with the writer of that article when he says "the scepticism, if not the derision of the expert designer," will be aroused. The figures given are of far too scrappy and vague a nature to convince one as to the merits or demerits of the designs. The writer claims the motor's ability to do 120 B.H.P. continuously, and 160 B.H.P. with ease. I challenge that statement, and before accepting it will need considerably more information than has been given, and I think your readers generally will be with me so far.

The figures given show a temperature rise after 3 hours of 56° F. on commutator and 38° F. on armature, with an *input*, not output, mark, of 63 KW., *i.e.*, but 75 B.H P. at the very highest.

But a machine of this size would not reach its final maximum temperature under 10 hours, and taking the time constant, or rate of increase of temperature, into account, from the figures given its final temperature rise of 75 B.H.P. would be of the nature of 60° F. for the armature.

From the nature of the design, if full advantage be taken of the interpoles, this will be essentially a "copper machine," and the bulk of the losses will be "copper losses," but to keep things favourable, let us assume that copper and iron losses are equal. It will be clear that the accepted rules regarding conservation of energy not having yet been discarded, some losses must take place, and it is pretty well certain that these losses in a machine of the size and speed mentioned will be of the nature of 13 per cent.

Of this we can apportion 7 per cent. to armature C^2R and iron losses. The dimensions given show a cooling surface not exceeding 1,400 sq. in.

We have, therefore, on 80 B.H.P.—normal full load—a loss of 4,200 watts, *i.e.*, 3·0 watts per sq. in., and on 120 B.H.P. 6,800 watts, *i.e.*, 4·9 watts per sq. in., and on 160 B.H.P. 10,600 watts, *i.e.*, 7·6 watts per sq in.

I think a fan to cool this armature would account for a goodly percentage of the input.

The above losses are underestimated, for in a machine of this type the copper losses would be at least twice the iron losses, which makes the position much worse.

Again, the speed being so low, the losses on the commutator are mainly brush C^2R losses, and if on 75 B.H.P. the temperature rise is 56° F. in three hours, I will leave readers to judge of the last state of that commutator, when subjected to 120 B.H.P.—meaning 2½ times the losses—for a long run, or to 160 B.H.P. as claimed.

As regards the brush current density being 50 amperes per sq. in., I have many motors running on an apparent density of 100 amps., ordinary carbon brushes, but it must be remembered that where commutation is perfect, high densities are possible, whereas on bad commutation, an apparent density of 30 amperes, that figure so sacred to consulting engineers, may often mean 200 to 300 amperes per sq. in. at the tip of the brush.

The designer of these machines draws attention to the fact that flux densities are pressed up to a very high value. This agrees with modern practice, but the economical limit is soon reached, owing to the present magnetic materials having limits of quality. Hence, high densities have obviously to be paid for in excitation losses or extra copper. Moreover, too high densities, particularly in the teeth, do not conduce to effective use of the virtues of the interpoles on overloads.

I should be interested, as would I think designers generally, were the writer of the article to substantiate his statements, by amplifying the very meagre data he has given. For instance, why not publish a test sheet, showing time run, temperature rise, rate of increase of temperature and efficiency?

It would be of value to the profession, also, were he to state the material and labour costs in terms of so much per B.H.P., as the statement italicised of "half the cost-price paid" conveys no meaning whatever, inasmuch as there are prices and prices.

Finally, I would say, in my opinion, and I state it with all humility, that until some brilliant discovery comes along,

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designers have to travel along a well-defined road to get the best result from given material, and the signposts are pretty evident to be :—

1. Ventilation.
2. Better space factors, *i.e.*, improved insulating medium.
3. Correct use of interpoles,

and last, but by no means the least important,

4. Educating consultants and Corporation officials as to safe temperature limits.

That this last is important will, I think, be conceded, when I state that quite recently, Corporation officials have gone so far as to lay down the exact insulation materials and thicknesses to be used, and to prohibit the use of fans for cooling, or axial ventilation through the armature core.

W. Rae Joss.

Harrogate, *October 13th*, 1913.

[Unfortunately our correspondent's assumptions are in many respects very wide of the mark; no doubt the designer of the motors will set him right. Meanwhile, the motors are running.—Eds. Elec. Rev.]

Specialisation.

I enclose herewith copies of two letters which we are sending out to the electrical industry, and shall be very much obliged if you will give such prominence to them as you may think fit.

Ferranti, Ltd.
A. B. Anderson, *Managing Director.*

London, *October 14th*, 1913.

To Switchboard Makers.

Dear Sirs,—As you will doubtless have seen from the Press we have, after careful and lengthy consideration, decided to no longer undertake switchboard contracts, the reason being briefly that we find our capacity entirely required for the manufacture of our standard catalogue lines, a business which has been increasing for the last two or three years. We may say that one consideration which helped us to this decision was our hope that our large experience in the manufacture of switchboards and switchboard details should ensure for us a very considerable clientèle amongst switchboard manufacturers, for such details as they themselves do not manufacture, in view of the fact that we shall no longer be a competitor for such contracts. Obviously, our withdrawal from this particular field—in which we may claim to have been particularly prominent—must necessarily benefit those remaining in the field, and we therefore feel entitled to hope for special consideration from those with whom we have until recently been in active competition when orders or contracts for detail gear were being placed.

The whole of our principal staff, without exception, in this department are remaining in our employ, and we think it not unlikely, therefore, that our lengthened experience, to which we have before referred, may enable us to be of some assistance generally to switchboard manufacturers.

There is no doubt in the opinion of the writer that a good many manufacturers are prejudicing their chance by expending too much energy upon the manufacture of small sections of their requirements of which they could be easily and profitably relieved by anyone specialising and manufacturing in large quantities. We hope that an appreciation of this consideration may lead to an extension of the movement, of which we believe our action is only the beginning.—We are, dear sirs, yours faithfully,

Ferranti, Ltd.

To Clients.

Dear Sirs,—We very much regret that we are unable to quote for the switchgear to your specification which you have been kind enough to send us.

Owing to the continuous growth of our meter department and the continual demands for more space, caused also by the corresponding growth of various other sections of our manufactures, we are reluctantly compelled to cease undertaking what we describe as heavy switchboard contracts.

During the last two years we have increased our works area by 50 per cent., and our capacity by some 75 per cent., in order to meet the aforesaid growth in our meter department, power and instrument transformers, switchboard instruments, oil switches, knife switches, circuit-breakers, and many other details of switchboard manufacture, as also heating and cooking apparatus. The whole of this detail manufacture we intend to continue.

We are also now selling a new form of compression motor starter which has proved so superior in our opinion to any other form of starter on the market during the course of four years' experimental and test work in our own works, and two years' experience of them in limited numbers amongst customers, that we anticipate a very large business in this starter, and all legitimate developments of the same in the direction of motor control gear, not only for D.C., but for A.C. machinery. Briefly stated, the demands upon our space and capital are now so great in what we might call our catalogue material, that we are, as we regretfully stated at the beginning of this letter, abstaining from tendering for switchboard contracts. Catalogue material, we ought to remind you, includes our line, a rapidly increasing business, in sub-station panels.

In cases where our gear is specially required, such as extensions, we shall, of course, do everything in our power to relieve our customers of any inconvenience resulting from this decision on our part. We believe that this inconvenience with our assistance, may be reduced to a vanishing point in view of the fact that there are several other switchboard manufacturers in this country who will be willing and able to undertake such work as might otherwise be entrusted to us.

If we might for a moment refer to the broader aspect of the question, we may say that we believe that any steps taken in the direction of specialisation and cheaper production must necessarily benefit all manufacturers, and, consequently, the industry as a whole.—Yours faithfully,

Ferranti, Ltd.

An Australian Power Station Contract.

The attention of the Agent-General for Western Australia has been called to the accompanying paragraph on page 616 of your issue of the 17th inst.

The *British Australasian* says :—Orders have been placed, without calling for tenders, in London for plant and machinery for the Government electric power station. The order was placed on the advice of Messrs. Merz & McLellan, the cost to be £188,251.

Inasmuch as tenders for the plant and machinery for the Government electric power station at Perth, Western Australia, were invited by public advertisements in London (in your paper amongst others), the statement is incorrect, and the Agent-General would esteem it a favour if you would cause the necessary correction to be made. The *British Australasian* is being asked to make a similar correction.

On September 3rd last, the Premier of Western Australia (The Hon. J. Scadden) made a statement in the Legislative Assembly of Western Australia in answer to a question regarding tenders for the Perth power house (see extract herewith from the Parliamentary Report), and if an incomplete report of his reply reached London, the cause of the error is accounted for.

Western Australia Parliamentary Debates.

Question—Electric Power Scheme, Plant.

Hon. Frank Wilson asked the Premier: (1) Having reference to the Government electric power scheme, is it a fact that orders have been placed for the plant and machinery in London without tenders being called locally, in the usual manner, for the same? (2) If so, were public tenders called in London or elsewhere? (3) What is the value of orders placed?

The Premier replied: (1) Yes. The provision of the plant and machinery for the Government power station was left almost entirely in the hands of the firm of Merz & McLellan, and, on their advice, and with the concurrence of the Agent-General and myself, when in London, tenders for various reasons were not called locally, the principal reason being the urgency of the matter, and the fact that only a limited number of firms could supply the necessary plant and material. (2) Yes. (3) £188,521.—*Legislative Assembly, Wednesday, September 3rd*, 1913.

Ernest E. Salter.

London, S.W., *October 20th*, 1913.

The Diesel Engine.

I have read Mr. Spalding's letter, and would like to comment on one or two points raised.

1. The makers certainly recommend a minimum pressure of 600 lb. for starting, but it is quite possible to start a small engine with a much smaller pressure if sufficient "blast" pressure is available to inject the fuel.

2. Opening of the valves of air vessels. The opening of the valve from compressor to blast vessel also opens up to one of the three pressure gauges. The second gauge is only used :—

(*a*) When engine is standing—to ascertain pressure in any of the receivers.

(*b*) When engine is running—to ascertain pressure in starting receivers.

We were accustomed to open this gauge to the starting receiver while starting the engine, so that the loss of starting air could be observed, and this was done at the time of the explosion.

(*c*) Should therefore read valve between starting vessel and gauge.

The air leaking past the cylinder valves was not from the fuel valve. Any leakage here is audible as soon as the valve from blast vessel to fuel valve is opened.

The leakage in question was only noticeable when the engine began to turn.

Mr. Spalding appears to overlook the fact that the Bray engine is a single-cylinder type, and that the blast pressure would not begin to fall until the starting lever was put into the running position, as the fuel valve was not leaking. The pressure would only fall about 10 lb. at each firing stroke. I consider that the blast pressure at the moment of the explosion could not have been less than 770 lb.

As the engine had previously been started up with very low pressure of starting air, and, at another time, with oxygen, one may assume that neither of these alone would cause the explosion. A combination of circumstances, each in itself practically harmless, often gives curious results.

The low starting pressure would result in slow starting speed, and, with a leaky valve, bad compression. This was evidently too low to fire the charge in the engine cylinder, but sufficient to fire the probably much richer mixture of oxygen and paraffin in the fuel valve. The traces of compressor lubricating oil in the blast pipe and receiver might have been harmless without the oxygen. With the oxygen it was disastrous.

The suggestion of a non-return valve in the blast pipe has been made several times. From my experience of the fierceness of the explosion, even along this small pipe, I suggest that such a valve would simply be blown to pieces without hindering the progress of the flame to any appreciable extent.

The driving of Diesel plants requires no more skill than does a modern steam plant, but greater watchfulness on the part of the driver is required. A careless driver will sooner or later lose the compressed air, and where only a single engine is installed this is a very serious matter.

For cleaning and grinding in the valves a careful, more than a clever, man is required, as in a small generating station where only an engineer and assistant engineer are employed, it is quite impossible to spare the time to watch every action of the fitter.

The clearances of the valve levers, however, should certainly be set by an engineer.

D. E. McDonnell.

Bray, *October 18th*, 1913.

Pressure Regulation.

I regret that there has been delay, owing to absence from home, in answering Mr. Allingham's letter on pressure regulation. The plan of separately exciting c.c. turbo-generators by direct-coupled exciters was, I believe, described in the columns of the Review some time ago. The reason for the design is probably as follows:—Should steam and vacuum fail on a compound turbo-generator, the friction of the air in the turbine would bring a load on to the generator, now being driven as a motor by other machines in parallel. A considerable current would thus flow back through the compound coils, which would greatly reduce the field strength, and consequently the generator, acting as a motor with a weak field, would run up to a high and dangerous speed. Where the generator was excited by a direct-coupled exciter, this danger would be obviated, for the exciter would increase its voltage, and thereby strengthen the field of the main generator when the speed was increased, thus limiting the generator speed.

Reverse-current breakers ought to prevent such troubles, but, unfortunately, these have been known to fail at the critical moment.

Replying to Mr. Allingham's query, *re* instability of fields in reversible boosters when operating with heavy currents and weak fields, I have had no trouble in this direction, nor would I expect any, particularly if the fields be laminated. Were the reversible booster to be unstable to the extent of, say, 5 or 6 volts round about the zero point, it would not appreciably affect the working. On the other hand, it is very annoying where one has a mid-wire booster on a generator with a choking coil mid-wire connection, to find that the pressure on one side of the system is 5 or 6 volts higher than the other, and that one cannot rectify the defect, owing the instability of the booster field. I believe that a number of mid-wire boosters have been scrapped for this season; but I cannot help thinking that they would have worked well had the air gap been large enough, and it would have been a further help if the fields had been laminated.

C. Turnbull.

Tynemouth Electricity Works,
October 20th, 1913.

LEGAL.

Prosecution of Colliery Officials: Judgment.

In the Hamilton Sheriff Court on Saturday last, Sheriff Hay Shennan gave judgment in a prosecution at the instance of the Home Office, in which Robert W. Dron and James Dalgleish, the agent and manager respectively of Dalziel and Broomside Colliery, Motherwell, were charged with 12 offences involving defects in the mechanical and electrical equipment of the colliery. The proof was a lengthy one, and keen interest was aroused in mining and electrical circles regarding the issue.

His Lordship has decided that as it has not been proved that Mr. Dron is the agent of the colliery the charges against him must be dismissed. He finds Mr. Dalgleish, the manager, guilty of several contraventions in regard to the mechanical and electrical plant of the colliery. On the whole, however, he regarded the position of the manager as much more favourable in relation to the electricity charges than it was with regard to the other offences libelled. Charge 7 relates to the unprotected condition of four fuses in a distribution box, and if there were defects he could not, he said, hold the manager responsible for these. It was not his duty to inspect the fuses in the distribution box; that was the duty of the electrician. Charge 8 was a much more serious one. It was one of failure to have covered with insulating material certain unarmoured cables, one at six places, one at three places, and two at 25 places each. The evidence in support of this charge was overwhelming. The bare parts of the cable were from 4 in. long downwards. He could not acquit the manager of the responsibility here. His duty of general supervision surely extended to observing the condition of the cables as he passed. Indeed, the manager made the mistake of thinking that on all matters relating to electricity he was absolved from responsibility. The four remaining charges related to matters of detail for which he could not hold the manager responsible. The ninth charge complained that certain cables were found resting on iron nails. They had been properly enough installed, but where the suspending material had given way the cable had been fixed up so as to rest on iron nails. The manager here, his Lordship thought, was justified in assuming that such matters would be attended to by his subordinate officials. He, therefore, could not convict unless it was proved that the manager had seen the improper fastening, and had acquiesced in its continuance. Charge 10 was founded on the fact that the signal wires were found in contact with the cables. Here, again, the original installation was efficient, and the manager was entitled to trust to his officials that it was maintained so. There was no evidence that he himself knew of the defect. Charge 11 related to a matter of small detail, the soldering of an earth conductor into a log, for which he could never hold the manager responsible. It was to be noted that charges 11 and 12 related to the construction of apparatus which was in use before June 1st, 1911. The apparatus satisfied the requirements of the Rules then in force, and the Inspector had not required it to be altered. Accordingly, it was impossible to convict under those charges.

In imposing a fine of £5, with the option of 20 days' imprisonment, Sheriff Shennan said he did not regard the offences as serious, but merely technical. Of course, in a case such as this, where a manager was convicted, a fine would require to be more than it would be for an ordinary miner.

Curious Workmen's Compensation Claim.

Sheriff Shennan, in Hamilton Sheriff Court, has issued his judgment in an important action brought under the Workmen's Compensation Act. The claimants were the widow and family of Wm. Gourlay, puddler, Wishaw, who sought payment of £300 from the Etna Iron and Steel Co., Motherwell, as compensation in respect of Gourlay's death, the contention being that he had been electrically killed on February 3rd, 1913, while employed with the defendants. It was alleged by the claimants that the deceased met his death by coming in contact with a heap of scrap iron which had been charged with electricity from the shears in the works. For the defendants it was contended that on the day of the accident, Gourlay was not in his usual health, and that for the past 15 years he had suffered from fatty degeneration of the heart. They denied that the heap of scrap metal had become charged with electricity. His Lordship, in holding that the claimants were not entitled to compensation, said that the evidence was wholly insufficient to prove that Gourlay suffered from electric shock. It was incredible, he thought, that the shearman, John Smith, should have been working about the shears and the scrap all day without experiencing the slightest shock. Again, on the day following the alleged accident, the police sergeant put on the current and was entirely unable to find any place where an electric shock could be got.

Tramway Passenger's Claim for Dog-Bite.

An action was brought in the Dundee Sheriffs' Court by a woman, who sued the Corporation for £20 for loss and injury sustained by her in respect that while a passenger on a tramcar travelling between Broughty Ferry and Dundee, she was bitten in the face by a dog which had been allowed to travel in the car. Sheriff Neish decided in favour of the Town Council. It was pointed out that according to the tramway by-law, the conductor might allow any person to enter a car with a dog.

Tramway Accident Claim.

In the Court of Session, Edinburgh, last week, the record was closed in an action against the Musselburgh and District Electric Light and Traction Co., Ltd., for £500 damages in respect of the death of a two-year old child. The father of the child attributes the accident to the negligence of the driver of the car, but the defenders deny fault and plead contributory negligence.

Factory Act Prosecution.

At the Huddersfield Borough Police Court on Friday last, the proprietors of the Mirfield Motor Works were summoned for a breach of the Factory Act Regulations, it being alleged that they allowed the use of a portable electric lamp which did not comply with the regulations.

Mr. H. J. Peacock, H.M. Inspector of Factories, Huddersfield, said that on July 24th a workman named Thomas Roxborough received a shock from an electric lamp which he was using, and he subsequently died. Mr. Peacock did not allege that the death was directly attributable to the lamp, but the case was brought as a warning against the use of such a dangerous lamp.

Mr. G. Scott Ram, Electrical Inspector for the Home Office, said the lamp, which he had examined, did not conform with the regulations. The holder was in metallic connection with other metal of the lamp, and there was a brass tube running through the handle, and if there was any leakage in the lamp the metal guard and the brass at the end would become "alive." A man standing on damp ground and holding the lamp would probably receive a shock, and might not be able to let go. There should have been a third wire connected with the earth.

The Magistrate's Clerk (Mr. C. L. W. Nicholson) said he would advise the Justices that the death of the man had nothing to do with that case.

A fine of £5 and costs was imposed.

Tramway Assessment Appeal.

At the Salford Hundred Sessions on Monday, the chairman gave judgment in the rating appeal brought by the Salford Corporation against the Assessment Committee of the Barton-upon-Irwell Union and the overseers of Eccles, heard at the last sessions. He said the Court had decided to treat the tramways in Eccles as an integral part of the whole system, in considering what a hypothetical tenant would look at in dealing with the tramways. Therefore they dismissed the appeal with costs.

Mr. Sutton, on behalf of the appellants, asked the Court to state a case, but the application was declined.

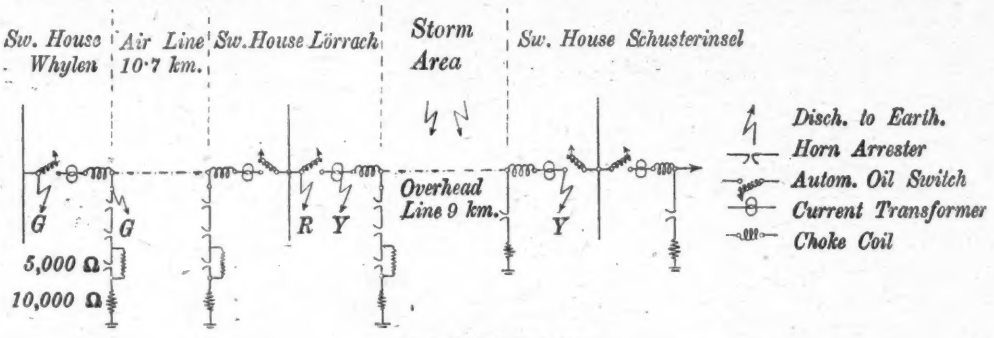
The Chairman remarked that the decision was based on a question of fact, and not of law.

A DISASTROUS OIL-SWITCH FIRE.

A recent report by the Schweizerische Elektrotechnische Verein is concerned with a serious oil-switch fire which occurred last spring in the new power station at Wyhlen. In this installation the switchgear is erected in a separate four-storey building, distant 80 m. from the generator house and occupying a ground space of 66 × 12 m. The ground-floor is occupied by 7,000-volt bus-bars, the first floor by 7,000 and 45,000-volt oil switches; the second floor by 45,000-volt bus-bars, and the third by lightning arresters and the departing transmission lines. The switchgear is designed and erected on the latest principle, a cellular construction being adopted and Duro-plate partitions being employed between the three phases on the 7,000-volt board and between individual phases in the 45,000-volt section. Porcelain insulators are used where conductors penetrate walls. The double line 45,000-volt transmission is carried by lattice masts, and an automatic oil switch is connected in each line in the switch house.

On April 24th last, at 4 p.m., there was a thunderstorm in the Wyhlen-Lörrach district, and the 45,000-volt line was struck by lightning. The two line switches in the switch house opened and one exploded, making a loud report and shaking the whole building. The location of this switch was such that access to the seat of the fire, which at once broke out, was delayed for a short time. The conflagration spread with remarkable rapidity, and the dense smoke created hindered operations considerably. Four patent fire extinguishers were emptied against the burning switch without avail, and all endeavours to approach the switch from other directions proving fruitless, nothing could be done till smoke helmets and oxygen apparatus arrived from the Basle fire station. Owing to the intense heating of the chequer plate flooring which meanwhile occurred, it was an hour and a half before the fire could be fought in earnest. Naturally, the whole station was shut down, and the switch house rendered "dead" immediately the switch explosion occurred, and everything possible was done to localise and retard the fire by blocking up windows and doors. The fire was completely subdued about 8.30 p.m. The exploded switch was of the latest A.E.G. 40,000-volt electromagnetically-operated type, the poles being immersed in separate oil chambers, and having two breaks per pole. The stroke was about 190 mm., the effective breaking distance 290 mm.; break, 280 mm. below oil level; distance to earthed metal, 150 mm.

An examination of the switch after the disaster showed that, owing to the shearing of the gear wheel pins in the oil tank winch gear, the red and yellow phase oil boxes had fallen down. The intense heat to which the parts had been subjected had fused certain pieces together, and fallen masonry had broken other parts; the heat of the arc had melted the upper leads and some of the iron in the switchboard framework in the neighbourhood, while the heat and the force of the explosion of the gases produced by the volatilisation of the oil had together caused serious damage to the reinforced concrete construction in the vicinity. A particularly unpleasant result of the fire was the deposition of an oily soot over practically everything in the switch house.



G, R, Y represent the phases.

Disastrous Oil-Switch Fire; Diagram of Connections.

Examination of the lines showed that discharges to earth had occurred as indicated in the accompanying diagram, and the cause of the switch explosion was undoubtedly the inability of the switch to break the short-circuit current which flowed when all three of the Lörrach lines were shorted to earth by their lightning arresters. At the time of this short-circuit, there were in service seven generators, each of 3,000 K.V.A. maximum capacity and 6,800-7,000-volt terminal P.D. at 107 R.P.M., supplying the line through 6,300/45,000-volt transformers.

The fact that such serious results followed the combustion of a comparatively small quantity of oil (440 gallons in all) is explained by the rapid generation of choking smoke. A few minutes after the outbreak it was impossible to penetrate to any part of the large switch house without smoke helmets, and by the time these arrived the fire had assumed serious dimensions.

It being admitted that, despite careful study of the unfavourable conditions to which oil switches may be subjected in large modern stations, explosions cannot be completely eliminated, attention must be paid to means of removing the oil which then becomes so grave a source of danger. Further improvements are possible in the suspensions of the oil tanks (to prevent the latter being upset) and an emergency draining valve should be fitted, to open in the event of greatly increased pressure in the switch chamber and to permit the oil to flow away.

It is also open to question whether under modern conditions of electricity generation and distribution, the practice of mounting all the main switchgear of the station in one building, however completely the various switch compartments are isolated with regard to each other, must not give place to entirely distinct switch houses for the several generators, transformers and transmission lines. Wholesale failure of supply and damage of apparatus not directly concerned in a breakdown would then be eliminated. In many cases, the generating capacity of stations has been increased without corresponding increase in the capacity of the oil switches

initially installed, and in such cases the installation of quick-acting automatic switches in the bus-bars would limit the generator capacity acting on a short circuit and would much reduce the risk of disaster in the oil switches, which are often loaded almost to the limit of safety under normal operating conditions. Finally, large oil switches, and particularly those which (being designed for extra high tension) employ large quantities of oil, should be erected in compartments provided with openings to the atmosphere for the ready escape of smoke in case of fire. Suitable smoke helmets, easy to fit and use, should be provided near the switch house. The design and use of large oil switches has hardly kept up with recent developments in large central-station design and operation.

SOME NOTES ON GRAPHIC INSTRUMENTS.

By KENELM EDGCUMBE.

(*Paper read before the* Arc Works Engineering Society.)

I hardly think that any apology is necessary for the use of the word "graphic" in the title of this paper. Everyone knows what is meant by a "*graphic* wattmeter," whereas no one knows what is meant by a "*recording* wattmeter." We are all agreed as to what the latter ought to mean, but not even consulting engineers are infallible, with the result that the greatest confusion has arisen through the use of the word "recording" when "integrating" was intended. But I venture to go a step further. The expression a "graphic instrument" is too long, and I am, therefore, proposing to abbreviate it into "grapher." The stoker stokes, the booster boosts; why should not the grapher graph? At any rate, there are many precedents for the suggested innovation.

The expression "graphic wattmeter," &c., has already been taken up in many quarters, and it is to be hoped that the Nomenclature Sub-Committee of the International Electrotechnical Commission, which is now endeavouring to obtain international agreement as regards electrical terms, will see its way to recommend the adoption of the expression "graphic," even if its dignity prevents it going a step further and adopting the "grapher" also.

It will possibly be held by some that a more serious subject for apology lies in the title of the paper which, instead of being "Some Notes on Graphic Instruments," ought to be "Notes on *some* Graphic Instruments" (and those chiefly made by my own firm). If so, I accept the rebuke in all humility.

It may safely be said that in no other country have graphic instruments reached such a high state of development as has been the case in Great Britain. For this satisfactory state of affairs considerable credit must be given, I think, to the Board of Trade who, by their insistence from the first on the keeping of continuous records, have made accurate graphic instruments a necessity.

The most obvious way of constructing such a grapher is to attach a pen to the end of the pointer of an indicating instrument, and so cause it to trace a line on a paper chart which is, in the meantime, being moved steadily forward under it, by means of a clock. The paper chart may conveniently be marked with cross lines to represent hours, and with longitudinal lines, each corresponding to a definite value of current, pressure or other quantity.

One of the first difficulties which besets the designer of such an instrument lies in the disturbing effects of friction between the pen and the paper, and to overcome this the working forces must be made as large as is reasonably possible. The minimum torque which can be regarded as satisfactory depends upon a number of factors, such as the width of the chart, the form of the pen, the length of the pen arm, the nature of the chart and so forth. In this respect, a graphic instrument differs from an indicating one, for, in the latter, the chief criterion is the deflecting force, as compared with the weight of the moving parts, the ratio torque weight representing a sort of frictional "figure of merit" in this respect. With a grapher, on the other hand, pivot friction is of small account compared with that between the pen and the chart. The criterion, in fact, is the restoring force called into play by a definite displacement of the pen arm. In other words, the frictional "figure of merit" in this case is more nearly :—

$$\frac{\text{Force at the pen point corresponding to full deflection.}}{\text{Width of chart.}}$$

If the force is measured in grammes and the width of the chart in cm., the ratio should be not less than 0·05, for satisfactory working, and should preferably be not less than 0·1.

The force in question is equal to the torque of the spring (in gramme-centimetres, say) corresponding to full deflection, divided by the length of the pen arm, consequently the "figure of merit" becomes :—

$$\frac{\text{Controlling torque corresponding to full deflection.}}{\text{Width of chart} \times \text{length of pen arm.}}$$

In the case of instruments having suppressed zeros, if the frictional error (as measured by the distance the pen lags behind the correct reading) is to be no greater than that of the corresponding free zero instrument, a spring of the same strength must be used in each case, but "set up" to the requisite amount. Or, looking at the matter from another point of view (no matter what may be the nature of the control used, so long as the chart is moderately evenly divided), the torque in the above expression may be taken as being the difference between the respective torques at the two ends of the chart. From the above considerations it will be clear that a mere knowledge of the *torque* due to the spring is of little or no value in the case of a grapher, a fact frequently forgotten when comparing one pattern with another.

Graphic instruments may be divided into three main groups, according to the method employed for tracing the record on the chart :—

1. Those in which the pen is attached directly to the measuring instrument, which has sufficient force to render pen friction negligible.

2. Those in which friction is eliminated altogether by keeping the pen out of contact with the paper chart. (The word "pen" is here used in its very broadest sense, seeing that in most cases no ink, and consequently no pen, in the ordinary sense, is employed.)

3. Those instruments in which the pen is in contact with the chart in the ordinary way, but instead of being attached directly to the moving system, is controlled through a relay.

Graphers of the first group, which are by far the most numerous, are dealt with in more detail later.

Of those belonging to the second group, mention may be made of the spark apparatus of Siemens, in which a high-tension spark from an induction coil passes from the pen point through the chart, thereby leaving a trace on the paper. Another grapher belonging to this group is the "inkless" instrument of the author's firm, which has recently been modified in a number of important details. The principle is well known, and consists of an inked ribbon stretched across the chart, against which is a steel point attached to the pointer, being pressed against it at intervals. By this means a series of dots, each one corresponding to the position of the pointer at the moment, constitute the record upon the chart. A momentary current is sent by a master controlling clock, constructed on the Synchronome system, and this current, which only flows for about $\frac{1}{10}$th of a second and amounts to $\frac{1}{2}$ an ampere, is repeated at regular intervals of one or five seconds, according to whether the quantity to be measured is varying rapidly or slowly. These impulses work the tapping mechanism for making the record and also drive forward the paper chart. Moreover, any number of graphers can be connected in series, so that all receive precisely the same number of impulses, with the result that the charts are driven forward in absolute synchronism, thus eliminating all uncertainty as to the timing of any number of instruments on a switchboard, which is often a matter of considerable importance in the event of some disturbance occurring on the system. It is also quite easy so to arrange matters that the switchboard clock and, in fact, all clocks, workmen's time checks and so forth about a works are controlled from the same master clock.

Besides the great advantage of being able to synchronise all the charts in this way, it must be remembered that in the intervals between the impulses the pen arm is absolutely free to move, unimpeded by friction of any sort, except that of the jewelled bearings, so that almost the same precision is possible as can be obtained from the corresponding indicating instrument.

To the third or relay group belong, amongst others, the Callendar instrument, which was one of the earliest to employ this principle, and which has been applied to various zero methods, particularly in connection with pyrometers of the resistance pattern. It has not, so far, been developed as a graphic ammeter, wattmeter, &c.

In this apparatus, the galvanometer pointer deflects between two platinum disks, the deflection causing it to make contact with either one or the other. So soon as this occurs a circuit is closed and a relay acts, which causes the bridge contact to be drawn along

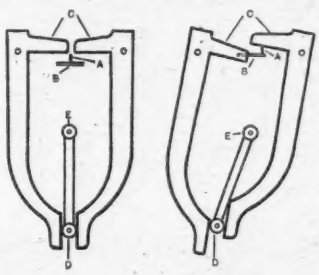


Fig. 1.

by clockwork until balance has been restored and the galvanometer ceases to make contact. The slide wire of the bridge is stretched across the chart and the travelling carriage has fixed to it, besides the contact, an inking pen by means of which a continuous trace of the position of the contact is obtained upon a paper chart which is driven forward by clockwork.

A more recent arrangement is the Olivetti graphic wattmeter, in which the wattmeter pointer closes the circuit of a small motor which draws the pen across the chart, and at the same time introduces a gradually increasing controlling couple tending to oppose the deflecting force of the wattmeter. So soon as these two forces are equal, the circuit is automatically broken, and the pen ceases to move until a further change in the deflecting force again closes one or other of the two relay contacts, and so causes the motor to move the pen forwards or backwards once more.

The latest addition to this group is the mechanical relay arrangement due to Mr. Leeds. The actual device is somewhat complicated, but the underlying principle may be gathered from fig. 1. This instrument, like that of Callendar, is only applicable to zero methods. The galvanometer pointer A is pressed up periodically by means of the plate B, and so long as A is central (that is at zero) it

merely rises and falls in the space between the two levers C C. Should the galvanometer be deflected, however, as shown in the right-hand figure, the plate B, in rising, forces the pointer against the right-hand bell-crank lever C, raising its upper end and forcing the lower end to the left, at the same time carrying the pen D with it. The arm to which D is attached is pivoted at E and is periodically brought back, mechanically, to its vertical position. During the process of being restored to this position it is momentarily geared to the bridge or potentiometer contact which also carries the pen and is, by this means, pulled in one direction or the other across the chart until balance has been restored. When this occurs, the galvanometer pointer comes once more to zero and, consequently, passes freely up and down between the two levers C C. Instead of the above movements being carried out by a clockwork mechanism, a small motor is kept continuously running and, by means of an ingenious form of governor, the speed is maintained so steady that the chart itself can be driven forward by it.

All graphic instruments working on the relay principle necessarily suffer from the disadvantage of being unable to follow rapid fluctuations of load, since even under the most favourable conditions the pen takes quite an appreciable time to travel from one side of the chart to the other, usually not less than a quarter of a minute. They are, therefore, only suitable for recording quantities which change but slowly, such, for example, as furnace temperatures; and even for this purpose they would hardly seem to possess any very marked advantages over the much simpler devices described.

It need hardly be said that one of the most important features of a graphic instrument is the pen, and many are the forms which have been tried. The simplest of these, and one which proved satisfactory for use with graphic barometers and other instruments,

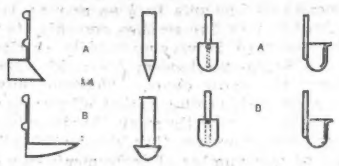


Fig. 2. Fig. 3.

is the spoon pen shown in fig. 2, B. This device has been modified in various ways, with a view to obviating some of its drawbacks, among which may be mentioned the following.

The ink is very liable to dry up, and only a very small quantity can be contained in the pen. There is considerable danger of the ink being thrown out in the event of the pen arm coming violently against one of the limiting stops. Considerable pressure is required between pen and paper to ensure the ink flowing satisfactorily and, owing to the shape of the pen, a comparatively thick line is usually traced. One modification, which has proved satisfactory in practice, is shown in fig. 2, A. It is made up of a single piece of metal, and whilst overcoming most of the objections mentioned above, has the advantage of allowing the filling to be done by squirting the ink in from the back.

The modern tendency, however, is towards the "bucket" form of pen, two useful modifications of which are shown in fig. 3. An

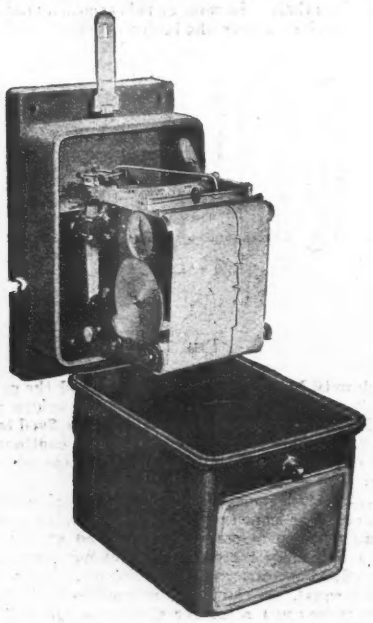


Fig. 4.

obvious drawback to pen A lies in the fine capillary tube which is liable to clog, and is at all times difficult to clean. The other pen B gets over both these difficulties and gives a very satisfactory record.

A source of error which must be carefully guarded against in all graphic instruments of the pen pattern, is the fact that the weight of the pen varies according to the quantity of ink in it, and this variation necessarily affects the indications. The larger the working forces, the less is the disturbance; but when a supply of ink sufficient for a long and variable record is required, the error is difficult to eliminate.

A method which has been used for obviating errors due to this cause consists in a narrow trough fixed parallel to the chart, and into which dips a capillary tube carried at the end of the pen arm and terminating in a fine point pressing against the chart. Whilst this arrangement takes the weight of the ink off the pen arm, it suffers from the disadvantage that the trough collects dust, and that the ink, being exposed, tends to dry up, and thus increases the frictional resistance in a very short time, unless cleaned out at frequent intervals.

The only real solution of this problem, without the use of relays or other complications, would seem to lie in the centrally placed

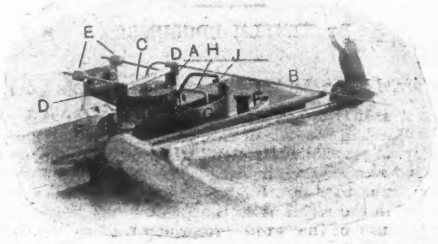


Fig. 5.

ink reservoir, such as is employed in the "Ink Well" pattern of grapher shown in figs. 4 and 5. The ink is contained in the reservoir A, into the centre of which dips the end of the inking tube B. This tube has a steel cross piece C fixed at right angles to it, resting in the forks D D carried by the moving system. The weight of the inking tube is counterbalanced to such an extent by means of the adjustable weights E, that there is just sufficient pressure between the point and the chart to give satisfactory inking. Owing to the fact that the writing point is on a level with the ink in the reservoir, very little pressure is needed, and frictional errors are reduced to a minimum.

The ink reservoir, which is of considerable capacity, is almost completely closed in, so that the ink neither dries up nor gets dusty, and a sufficient supply is held in the container for at least a month's record, even with an abnormally variable load. The ink reservoir is easily removed for cleaning or refilling, by means of the handle J, and the inking tube can be washed out at any time, should this be necessary, by lifting it out of its supports and holding it under a tap. An oil damper G, held in place by the two

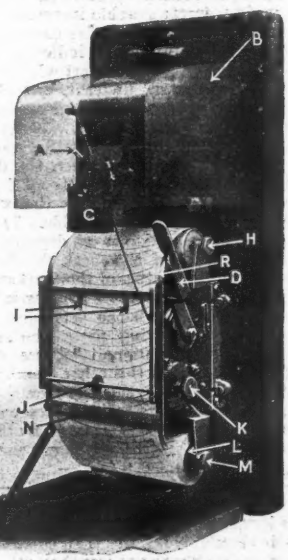


Fig. 6.

milled-headed screws F, serves to impart the requisite amount of dead-beatness to the movement by means of a vane attached to the arm H.

Amongst the advantages of this instrument may be mentioned the following:—Enough ink is carried for at least a month's record, and the chart lasts also for this period, so that, apart from a weekly winding of the clock, no attention whatever is required. The ink is not contained in the pen, and, consequently, as has been pointed out, the question of whether the reservoir is full or empty is without effect on the accuracy. The pressure of the pen on the paper is not appreciably affected by any accidental bending of the pen arm. The electrical movement has a vertical spindle, so that all the weight is carried centrally upon a single jewel, instead of by a horizonal spindle pressing upon the sides of two such jewels. The pen writes on a flat surface, whereby friction is considerably reduced. The writing surface being horizontal, there is no tendency

for the ink to flow down the chart in a kind of river, as is so often seen in the ordinary grapher. The space occupied on the switchboard is only 11½ in. × 7½ in., and is thus considerably less than that taken by other instruments having the same width of chart. The chart, after leaving the inking point, passes down the front of the clock so that not only is an exceptionally long piece of record always visible, but the ink has time to become perfectly dry before being wound up on the lower roller. A direct reading scale is fixed just in front of the inking tube so that a reading can be taken at any time.

Next to the pen in importance comes the method of attaching it to the movement. One of the earliest arrangements, and one which is still used by many makers, is that borrowed from graphic barometers, &c., and consists in a German silver arm having a slight springiness, the pressure on the chart being regulated by a milled head near the point of attachment. One of the disadvantages of this arrangement is that should the arm become even

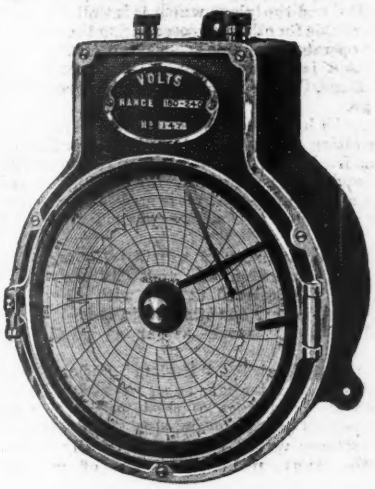


Fig. 7.

slightly bent, the pressure between the pen and the paper is very seriously altered; and, although adjustable by means of the milled head, it is a very difficult matter for the uninitiated to determine just how much pressure will give the best results. Various forms of hinged pen, some suspended near the top and others near the extremity of the arm, have been tried, but all suffer from the same defect—namely, liability to be seriously deranged by any bending of the arm.

After having tried, and at different times used, all the above forms of pen arm, as well as many others, the author's firm has finally adopted an exceedingly flexible arm fixed rigidly at the top.

The advantages of such flexibility are many. In the first place, owing to its suppleness, it is practically "fool-proof"; and even should it become bent, owing to excess of zeal on the part of the switchboard attendant, the pressure between the pen and the chart is but little affected, since it depends on the tension of a weak, but very much "set up," spring. The arm is also extremely light and strong while, at the same time, very rigid in the direction of motion.

Another matter of importance is the efficient insulation of the pen arm from the movement. In most cases a 1,500-volt test to earth is now specified, and, in exceptional cases, one of 3,000 volts, and it must be remembered that when replacing the charts the hand is almost certain to come in contact with the pen arm, so that its efficient insulation is a necessity, particularly in the case of continuous-current systems, where higher and higher pressures are coming into use, and the movement cannot be insulated from the circuit by current tranformers. In the Everett-Edgcumbe instruments this is ensured by attaching the pen to a solid block of ebonite, which would safely withstand 5,000 volts, moreover, in moving-coil instruments, this block is rigidly clamped to the coil, instead of depending on any form of screw, which is always liable to work loose with the continual banging against the limiting stops, to which graphic instruments are subjected.

Mention must next be made of that most important part of a graphic instrument, namely, the chart driving mechanism or clock. So long as it is merely a question of rotating a chart carrying drum, the problem is not a difficult one. Any strong clock will do the work and can be made to keep fairly good time. Now, however, that continuous band charts have become almost universal for station use, a very much more powerful driving mechanism is essential. When, moreover, it is stipulated that the chart shall wind itself up on a second roller, after passing under the pen, the difficulties become still greater.

Owing to the continually increasing diameter of this roller as the chart winds on to it, the speed of rotation must gradually be reduced so as to keep the peripheral speed always the same, namely, equal to that of the chart. This is usually arranged for by driving the auxiliary roller through a friction clutch which allows the necessary slip to take place. This slip, however, entails the provision of a very much stronger driving force than would otherwise be required, and it is largely due to a failure to recognise this fact that so many unsatisfactory driving mechanisms have been evolved in the past.

In the case of roll charts, a speed of 1 in. per hour will be found suitable for most purposes, while ½ in. per hour is a very useful speed for sheet and disk charts. For special purposes, however, very much higher paper speeds are required, often as high as a foot, or even more, per minute. For speeds exceeding about 12 in. per hour it is usually impossible to use an escapement, and this is replaced by some form of centrifugal governor. In many cases two alternative speeds are called for, and a gear changing arrangement is then provided, usually somewhat on the lines of the change-speed gear of a motor-car. When the high-speed range involves the use of a governor, while the low-speed range has to be regulated by an escapement, the change-over arrangement becomes more complicated owing to the difficulty of preventing the spring from running down while the change-over process is going on.

Closely connected with the clockwork is the chart itself and the method of driving it. In the first place, it is essential that the paper used should have the hardest possible "super-calendered" surface, as otherwise the ink will penetrate into the pores, and not only will a blotchy record be produced, but the ink in the pen will speedily be exhausted.

As regards the best width for the chart, a number of circumstances have to be taken into consideration, but 4 in. seems to have been accepted pretty generally as the most suitable, and attempts to introduce a 6-in. width have not, so far, met with much success.

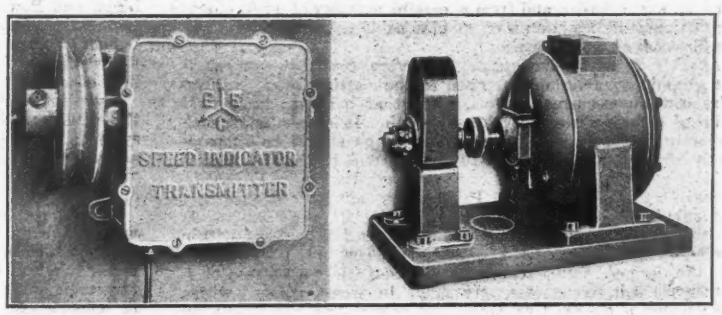


Fig. 8.

Fig. 9.

It has to be borne in mind in this connection that the same conditions do not apply to the width of chart in a grapher as to the length of scale in an indicating instrument, since in the former case almost the sole feature governing the accuracy is, as has been said, the friction of the pen on the paper, whereas in the latter it is usually the possibility of reading the scale at a distance which counts for most. For this reason, it is useless to increase the width of the chart unless the working force can be increased more than in the same proportion, which is in practice by no means easily done without, at the same time introducing corresponding disadvantages, such as a larger size of instrument, increased power consumption, overheating of shunts or resistances, and so forth. It should further be remembered that in the case of a graphic voltmeter, in which the greatest exactness is usually required, it is an easy matter to suppress the zero and thereby to open out the scale at any desired point. It may be pointed out that with a 4-in. chart the thickness of the recording line usually represents less than ½ per cent., so that there is no difficulty in reading the chart with all the precision desired.

It is sometimes put forward as a recommendation of some instruments, that the charts have rectilinear lines, but it is so seldom that a record has to be planimetered (and this would seem to be the only case in which there was any real gain in replacing the curved lines by straight ones) that it is doubtful whether the extra complication is really justified.

Of the various methods of driving the charts which have been devised from time to time, only two have survived, namely, the pin drive and the friction drive. This is, of course, excepting disk chart and sheet chart instruments, in which the chart is rigidly attached to the clock-work mechanism.

The pin-drive takes two forms. In the one the driving-wheel is provided with needle points which penetrate into the paper and in the other the charts are perforated with a number of small holes along one or both edges, and into these engage short pins fixed in the periphery of the driving wheel. A disadvantage of both these arrangements is that the pins passing into and out of the paper, even when perforated, necessarily introduce a certain amount of resistance to motion which has to be overcome by the clock.

The pin drive with perforated charts is used by the author's firm, in their Inkless Synchronised graphic instruments, already described, in order to ensure the absolute interlocking of the charts of a number of instruments driven by a common control clock. But for those cases in which a separate clock is used to drive the paper of each instrument, thus making it complete in itself, there would appear to be nothing gained by employing the pin wheel, and the friction drive then forms the most convenient arrangement. Fig. 6 shows a typical grapher clock employing a modified form of friction drive, namely, the R R. type of Everett, Edgcumbe instrument. A wheel with serrated edge is driven by the clock, and the chart is pressed against it by the jockey wheel J while kept flat by the two springs I. As the chart is unwound from the spool carrier H, and fed under the pen, it is automatically wound up on to the lower roller L. By turning the knob K by hand, the

chart can be moved forwards or backwards for time setting, &c. The spindle carrying this milled knob is driven by the clock and gears into a small pinion which can be seen in the figure. Since it is often difficult to obtain access to the side of the instrument, owing to the restricted space on the switchboard, a winding lever D is provided, which can be actuated from the front.

The daily sheet chart is still frequently called for by those who prefer to have each day's record complete in itself, and in such cases the disk pattern of grapher is coming more and more into use, owing to its compactness and comparatively low cost, as well as to the fact that a complete day's record is always in full view.

Such an instrument is shown in fig. 7, the overall dimensions being only 10½ × 8½ in. Owing to the use of the extremely flexible pen-arm already alluded to, a simple arrangement is possible whereby, when the front is opened for re-charting, the flat arm which can be seen lying under the pen automatically raises the latter from the paper, so as to make both the chart and the pen readily accessible without fear of damage.

In conclusion, allusion may be made to one or two special forms of grapher which have been developed to meet particular requirements. A form of combined graphic ammeter and voltmeter, spoken of as a "feeder log," is often useful. In these instruments, which have charts of extra width (usually 6 in.), two movements are placed side by side, the ampere record covering some two-thirds of the chart, while the volt record occupies the remainder. In this way, a continuous record can be obtained of the current and pressure on, say, a feeder, and from a careful scrutiny of such charts very valuable information is often obtainable as to the origin and ramifications of a disturbance.

Another form of instrument deserving special treatment is the graphic ammeter for insertion in the earth-wire of a three-wire continuous-current system, or in that between the neutral point of a three-phase generator and earth. It is essential, if such an instrument is to be of value, that its range should be comparatively low, usually from 10 to 20 amperes, and if the system mid-point is connected dead to earth, the current flowing on the occurrence of a fault is enormous. It is now becoming more and more the rule in three-phase installations to install a carbon-powder resistance in the earth wire, so as to keep the fault current within limits, but since this current has to be sufficient to trip the breaker on the largest feeder (unless a discriminating arrangement is employed) it is, in any case, very much in excess of that which the grapher is designed to carry. To protect the instrument, an automatic switch is usually installed which short-circuits the terminals of the grapher. Unfortunately, the action of such a switch cannot be instantaneous, and it is found that before it has had time to act the pen is thrown up to the end of the scale and, no matter how carefully designed the limiting stops may be, considerable damage is done.

To overcome this trouble, the author's firm has devised a small auxiliary short-circuiting switch, which is almost instantaneous in its action. It has its winding connected in series with the grapher, and immediately the current exceeds a pre-determined value, depending upon the range of the grapher, it short-circuits the latter. By this means the instrument is fully protected until the slower moving main switch has had time to act and cut it out of circuit.

In some cases the limiting resistance is not left continuously in circuit, but is only cut in on the occurrence of a fault, and this auxiliary is then of still greater importance. In either case, directly the main switch has acted and so cut the resistance into circuit, the auxiliary switch opens and the grapher is again free to record the current flowing. The fact that an earth has occurred is shown by the record, and in many cases an auxiliary contact is provided so as to ring a bell or to give some other warning to the attendant that one of the lines has gone to earth.

Another instrument of considerable value at the present time is the speed grapher, or, as it is often called, the "Tachograph." Such instruments are usually constructed on one of two principles, being either mechanically or electrically-operated. In mechanical tachographs, a fly-out governor arrangement, very similar to that of the ordinary tachometer, is employed, and to this a pen is attached.

In the electrical tachograph, a small magneto-generator is coupled to the machine whose speed is to be measured, and has its terminals connected to a graphic voltmeter. Since the E.M.F. generated by such a machine is almost proportional to the speed, the grapher can be scaled to measure speed direct, and has, moreover, the advantage of an evenly divided chart.

Fig. 8 shows the transmitting element of such a combination fitted in a water-tight case for use on boardship. An obvious advantage of the electrical as compared with the mechanical tachograph, is that the receiver can be placed at any distance from the transmitter, and hence from the machine under test, instead of having to be directly belted or geared on to it. Further, almost any number of direct-reading speed indicators or graphers can be worked from the same generator.

The transmitter of a graphic frequency meter is shown in fig. 9. It consists in a small A.C. motor directly coupled to the transmitting magneto-generator. The speed of the motor, and consequently the E.M.F. of the transmitter, is strictly proportional to the frequency, so that the grapher connected up to it can be marked direct in cycles per second. The range of the actual instrument illustrated in fig. 9 is 40 to 70 cycles, and the chart of the grapher connected to it is perfectly evenly divided. By means of such an apparatus a continuous record of frequency can be obtained by an instrument situated either on the switchboard or in the engineer's office and, further, any number of indicators or graphers can be connected in series and placed wherever it may be wished to know the frequency.

ELECTRICALLY-OPERATED ICE PLANT AT CHICHESTER.

During the last few years the advantages attending the use of ice and cold storage plant have become far more widely recognised, and a very considerable demand has arisen in all large towns for a supply of hard, clear, crystal ice, similar to the natural ice imported from Norway.

Owing to improvements which have recently been effected in ice-making plants, this class of ice can now be made and sold at a very low figure. A new field of development is thus opened out for central electric light and power stations, owing to the fact that the demand for ice is greater in the summer months of June, July, August and September.

The average electric supply company has a very heavy peak load during the winter months, and the plant which is installed to deal with this is generally available for other purposes during the summer. By using this power to operate a suitable ice-making plant, the ice can be made and sold at a large profit, and as the power load is levelled up to a large extent, the electrical plant can be operated to much greater advantage.

These facts have recently been prominently brought forward by Mr. Horace Boot (consulting engineer to the Chichester Electric Light and Power Co., Ltd.), and he finally placed the order with the Haslam Foundry and Engineering Co., Ltd., of Derby and London, who have for a large number of years made a speciality of this work, and have recently patented a new system for producing hard clear ice.

The plant, which has been running very satisfactorily for nearly the whole of this season, works on the ammonia compression system, and has been specially designed to work with the smallest amount of attention, which is very essential, as, in order to obtain the most economical results it must, as far as possible, be operated by the supply company's regular staff.

The ammonia compressor is of the "Haslam" enclosed type, which requires practically no attention, as all working parts run in an oil bath. Open air condensers of the interlaced type are fitted, and the pipes, as well as the pipes used in the ice tank and for cooling the cold storage rooms, are all electrically welded in continuous lengths, thus making the loss of ammonia impossible.

The ice tank is fitted with the "Haslam" patent system of air agitation, which keeps the water in the ice cans continually agitated, until the blocks are frozen up solid. The air used for this purpose is compressed and cooled to a low temperature in a special plant, and owing to the sterilising action of the air on the water, the ice produced is clear and free from impurities. The ice cans are fitted in groups in strong wrought-iron frames, each group being fitted up complete with air pipes and nozzles for supplying the compressed air, these being permanently attached to the cans and connected to the air main by a rubber hose and union, so that it is only necessary to disconnect this one union, and the group of cans can then be lifted by an overhead traveller, dropped in the relief tank, and emptied on a special can tip supplied for the purpose. The ice then passes down an ice shoot either to the ice store or to the loading platform as required.

The cold stores are insulated in the latest manner with cork insulation, the floors being covered with rock asphalt, which is also carried a short way up the sides of the chamber, this giving a waterproof and very efficient insulation.

The cold stores have a capacity of about 6,000 cb. ft.; they are divided into three chambers, one being used for the storage of ice, and the others for general cold storage purposes.

The plant has an output of 4½ tons in 24 hours in 2 cwt. blocks.

In the case of the plant forming the subject of this notice, existing buildings were utilised as far as possible, and the plant was carefully arranged to avoid expensive new construction.

RUBBER.

The position of the crude rubber market has not yet cleared itself, and the future is still very uncertain. The aftermath of the boom has indeed been a huge crop of tares. The position in Brazil remains very perilous, but the determination of the authorities to grapple with it, in so far as in them lies, is shown by the publication of a decree by the Brazilian Government authorising a reduction of 10 per cent. on the duties on rubber exported. This should help the rubber trade of the Amazon Valley, but there is grave reason for fearing that this trade has yet to go through a period of severe depression, for the simple reason that even under the relaxed conditions just put into effect the wild rubber trade cannot hope to live alongside that of the plantations of the Middle East. It costs far more to harvest the crude

rubber in the Amazon Valley than it does to produce that of Malaya and the adjacent territories, and at the moment there are plenty who think that the plantation industry can supply everything that the world wants. This may not be entirely accurate, but certainly the world does not want to pay even to-day's prices for all the rubber, wild and plantation, that is produced. Taking a view, the prospect of the trade should be better ultimately than present conditions demonstrate, for the wild rubber trade is doomed to virtual extinction with the standard grade of plantation at only a trifle over 2s. a lb., and no small part even of the plantation output can be produced at a profit at this figure. There is only one way for the matter to develop, and that is for the wild industry to pass through its crisis. When this is over, the price of rubber will have reached a more remunerative level, and it will be time then to take a fresh view, but for the present matters have yet to adjust themselves, and in the process someone is going to suffer. This someone is first the Brazilian, and next the high cost planter. The reckless way in which people rushed into rubber ventures during the crazy period of the boom is becoming mournfully apparent almost day by day, companies the shares of which were rushed up to premiums of hundreds per cent. now being on the rocks and derelict, not the smallest forethought having been exercised to bring their finances into relation to their responsibilities, and their management being too often of the utterly farcical order. There is a lot of weeding out to be done with regard to the plantation industry before it is purged from its errors, and this even though the industry is really now quite firmly established. These recurring reconstructions and fresh issues of capital are, however, fatal to confidence being restored, and it is little wonder under all the circumstances that the elaborately conceived scheme for the regulation of the selling end of the various plantation companies should have come to grief at any rate in the form proposed. It is stated on good authority that the cost of collecting rubber in Brazil is 3s. a lb., while it is asserted that 2s. 9d. a lb. will not pay for collecting the commoner grades of wild rubber, of which some 30,000 tons a year will be swept out of existence by the continuance of current selling prices, but not even this has been a factor of sufficient importance to induce harmony among the plantation interests. The proposals of the Malacca Co. received a good amount of support from the trade at large, but not enough for the scheme to be pushed forward in face of the aloofness, if not the hostility, of one important group, and the proposals accordingly were dropped. It has been stated publicly that the abstention of this group was due to their asserting that their costs were lower than those of the assenting companies, and possibly this may have had something to do with it, but a new proposal has now been formulated which involves the taking of a poll of shareholders in plantation rubber companies. It remains to be seen if this novel move is actually taken. Whether the individual shareholder is a good and competent judge of the methods by which the rubber trade is to be rehabilitated remains to be seen. In ordinary conditions directors and responsible officials of companies are those upon whose judgment the shareholders rely, but in this case the shareholder is practically to be called in to decide the policy for the directors and the officials, and a queer state of topsy turvydom is thus set up. It is doubtful whether any real good can come out of the proposals, which it must not be forgotten have for their actual objective the raising of the price of rubber. As has been pointed out before, the interference with natural conditions for the purpose of artificially raising prices is always a dangerous thing. The market is even yet anything but settled, and prices may fall further, but consumers would do well to bear in mind that there cannot be any additional very serious depreciation.

The British Fire Prevention Committee.—Last week the Committee's winter session was inaugurated with a series of three high-temperature fire tests, dealing with partitioning materials and with a reinforced concrete floor. There was on view an interesting collection of fire extinguishers which had been under test.

BUSINESS NOTES.

The Shops Acts.—The Blackpool Corporation has decided to make a general closing order, which will include shops in which electrical fittings and supplies are sold, providing that from the Thursday following the second Wednesday in October until December 15th; from January 1st until the Tuesday preceding Easter day; from the Thursday of Easter week until April 30th, shops shall be closed at the following hours:—Monday, Tuesday and Thursday, 7.30; Wednesday, 1 p.m.; Friday, 8 p.m.; and Saturday, 10 p.m.

Lead.—Messrs. James Forster & Co.'s lead report dated October 18th, reads as follows:—"Closing prices last week were £20 5s. October delivery, £20 October shipment, £19 12s. 6d. November, £18 13s. 9d. December, and £18 6s. 3d. January. The market opened on Monday firm with £20 2s. 6d. and £20 paid for October shipment. On Tuesday the Convention agents offered lead rather freely for October shipment and sold down to £19 15s. This rather upset dealers and the same delivery was done down to £19 12s. 6d. Since then we have had a strong market with advancing values and the close is at £20 15s. buyers October delivery, £20 10s., £19 13s. 9d., £19 7s. 6d. and £18 13s. 9d. paid for October, November, December and January respectively. There is no need to emphasise our frequently expressed opinion that we are approaching a time of serious danger as far as lead supplies are concerned. During the last three days, October delivery lead has been repeatedly asked for without finding a seller, and yesterday £20 15s. was bid for this delivery in vain. Important works in the Thames are almost at a standstill for lead and others are approaching this position. The provinces are asking London for prompt or early lead, and the requirements for export for this month are large and, as far as we can judge, will only be partly met. There is, in addition, a considerable 'short' account on this market, particularly on behalf of German speculators, who have sold freely for months past forward lead at considerably below current prices. Altogether there is reason for considerable apprehension as to the immediate future, and Mexican affairs do not tend to lessen it. English lead, £20 15s. to £21."

Ghent Exhibition.—Messrs. Ferranti, Ltd., have been awarded a Grand Prix for their exhibit at Ghent, which included amongst other gear a high-tension three-phase 6,600-volt ironclad motor panel of the totally-enclosed interlocked type. These ironclad panels form one of the lines in which the firm have specialised for some time past, and they now have a complete standard range of such panels for all classes of high-tension work, both for motor control and for feeder distribution. The panels are very fully interlocked; the doors of the panels cannot be opened unless the whole of the accessible gear in the interior is "dead"; the oil switch must be opened before the isolating switches can be closed, and it cannot be closed unless the isolating switches are completely opened or completely closed; the isolating switches cannot be opened unless the oil switch is open, and cannot be closed unless both the oil switch and earth switches are open; the earth switch cannot be opened or closed unless the isolating switches are completely open. One of these panels is on view at the firm's showroom at Central House, Kingsway, where the working of the panel can be shown to anyone who is interested in this class of gear.

Private Arrangements.—Christopher Snowden, electrical and gas engineer, 129, Arundel Street, Portsmouth.—A meeting of the creditors in the above matter was held on Tuesday last week, when a statement of affairs was submitted which had been prepared by Messrs. Oscar Berry & Co., of Portsmouth. This showed liabilities amounting to £252, and net assets £95. It was reported that the debtor started trading at his present premises 12 years ago, and in 1908, being in difficulties, entered into an arrangement under which the creditors were paid 6s. 8d. in the £. The household furniture was claimed by the debtor's wife. Some discussion took place at the meeting, and it was eventually resolved to confirm the deed of assignment executed in favour of Mr. Oscar Berry as trustee, and that the debtor be given 14 days in which to find a composition of 5s. in the £, such composition to be paid within a reasonable time.

The Aluminium Market.—A meeting of the constituents of the International Aluminium Syndicate took place in Paris recently, when it was decided not to make alterations in the minimum prices. For the purpose, however, of securing uniformity in the different countries, it was agreed to fix the minimum also for Germany at 100 fr. per cwt. in place of the rate of 80 marks per cwt. hitherto in operation. The general conditions referring to purity of products, extra prices, &c., experienced no change, and business was thrown open for the ensuing year.

Electrical Production of Metals.—The Electro-metallurgical Works Co. has been formed at Horrem, near Cologne, for the erection of a large experimental installation for the electrical production of metals on the lands of the Beissel Mine, near Horrem. The share capital amounts to £50,000, and the undertakings interested are the Chemische Fabrik Griesheim Elektron and the Metal Bank and Metallurgical Co., of Frankfort-on-Main.

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Book Notices. — *General Directions for the Use of Electric Cooking Stoves.* By Mrs. W. T. A. Cross. London: Lake, Sison & Brown, Ltd. Price 2d.— This is a pamphlet giving simple and straightforward instructions in the art of electric cooking; not cooking recipes, in the ordinary sense, but explanations regarding the points of difference between electric and gas cookers, and the right way of using the former to the best advantage. Even without instruction, says the author, very good results will be obtained, but with intelligent management electric cooking will also be found to cost no more than gas cooking. Advice is given regarding the choice of utensils, and clear instructions follow as to the use of the grill, the oven, &c., with the proper temperatures for the various operations. A thermometer is essential if the oven is to be used in the most economical manner. Directions for cleaning the oven are included. The booklet is admirably calculated to guide the user to success, and the only point to which we take exception is the reference on p. 7 to short-circuiting the grill. A grill which is liable to damage in this way is not well adapted for use in the kitchen.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 3, July-September, 1913. London: John Murray. Price 2s. 6d. net.

The Teaching of Electric Light Switching. London: Messrs. A. P. Lundberg & Sons.—In this new edition a number of highly favourable opinions of teachers are quoted, showing that the pamphlet has filled a real want; the outline lectures have been divided into groups; particulars are given of the firm's free examinations and certificates, and their sectionised switch-and-lamp demonstration boards are described. Messrs. Lundberg have undoubtedly brought into merited prominence a branch of electrical fitting which had previously languished in obscurity, and their well-directed efforts towards developing this subject deserve the thanks of both contractors and consumers

Dissolutions and Liquidations. — The Batley Electric Carbonizing Co., Ltd.—A meeting is called for November 20th, at Prudential Buildings, Market Place, Dewsbury, to hear an account of the winding-up from the liquidator, Mr. H. Appleyard.

Saville & Watson, electrical engineers, 8, Bream's Buildings, Chancery Lane, W.C.; Cobham, Surrey; and Cardiff.—Louis Alfred Thomson and Kenneth Walton Neild have dissolved partnership. Mr. L. A. Thomson will attend to the debts and continue the business under the same style at the same address.

The Ridings Arc Lamp Co., Ltd.—This company is winding-up voluntarily, with Mr. F. Rawlinson, 46, Liscard Road, Seacombe, as liquidator. A meeting of creditors has been called for November 6th, at 9, Parr Street, Liverpool.

The District Electric Co., Ltd.—A meeting will be held at 115, Colmore Row, Birmingham, on November 24th, to hear an account of the winding-up from the liquidator, Mr. J. W. Hinks.

The Nevile Engineering Co., Ltd.—A meeting of creditors is called for November 1st, at 9, Foregate Street, Worcester (Mr. G. W. Bull, liquidator). A circular issued by Messrs. A. J. Urwick and C. J. Rafarel expresses regret that it has been decided to wind up, and states that the business is to be offered for sale as a going concern. It is added that there is the nucleus of a good business; £8,000 has been spent on works, plant, &c., the turnover is about £7,000 per annum, and the orders on hand at present amount to about £3,000.

Bankruptcy Proceedings. — Bernard Musgrave, director of a limited company, late of Astley Bridge, Bolton, Lancs.—November 1st is the last day for receipt of proofs for dividend by the trustee, Mr. T. H. Winder, 19, Exchange Street, Bolton.

E. J. Crosier (Crosier, Stephens & Co.), engineer and merchant, Newcastle-on-Tyne.—A fourth and final dividend of 10d. in the £ is payable October 31st. Trustee, Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

Harold W. Lake, patent agent, 7, and 8, Southampton Buildings, London, W.C.—A composition scheme was approved by Mr. Registrar Brougham on 17th inst., under which 7s. 6d. in the £ will be paid to creditors. Debtor lost money in speculating in rubber and rail shares.

Sydney A. M. Rose, 75, Elgin Mansions, London.—Receiving order made on October 16th on a creditor's petition.

Starting Currents of Ferranti Meters.—Messrs. Ferranti, Ltd., have drawn our attention to the performance of a batch of six meters (5 amperes at 200 volts) recently tested at the National Physical Laboratory; four started with 0·015 ampere, or 3 watts, the other two taking 0·02 and 0·03 ampere respectively, so that they would all start with about half the current taken by a single tungsten lamp of the smallest size at present on the market, and most of them with less than one-third of that current. Thus if the ½-watt lamp of ·10 c.p. ever becomes an accomplished fact, the Ferranti meter will be able to record its consumption with ease, even when only one lamp is alight. In other respects the calibration curves of these meters are equally satisfactory.

Buckingham Palace Front.—During the night shift work on the reconstruction of the front of Buckingham Palace, Royal Ediswan drawn-wire lamps, were exclusively used to illuminate the scaffolding. On this scaffolding, where work of a heavy nature was continuous night and day, an electric lamp of great strength and brilliance was required. The lamp used carries the Royal Warrant, both to King George V and to Queen Alexandra. The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, have recently secured the following important contracts for the above type lamps:—General Post Office, the British Admiralty, the British L. M. Ericsson Manufacturing Co., and the United River Plate Telephone Co.

Catalogues and Lists.—The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—Price leaflet (6 D) of C.H. lamps fitted with light-transforming reflectors giving normal colour effects.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Pamphlet No. 250 briefly describes, and gives prices of, new competitive lines of electric irons, boiling plates, electric kettles, and a small cooking outfit. Copies will be sent on application.

Messrs. Sir W. H. Bailey & Co., Ltd., Albion Works, Salford.—List No. 2,813 (four pages) gives an illustrated description of the firm's direct contact feed-water heater, grease skimmer and air expeller with automatic control gear (Clausen's patent).

Messrs. Siemens Bros., & Co., Ltd., Woolwich.—Supplement No. 1 to Catalogue 502, is a leaflet giving an illustrated description, with price, of high resistance temperature indicators with pivoted coil and compensating resistance.

The Electrical Co., Ltd., Charing Cross Road, London, W.C.—Folder giving prices and brief particulars of the "A 1" and "F" type Bastian heaters, and the "Pygmy" heater.

Messrs. Cruse Controllable Superheater Co., Manchester.—Twenty-page catalogue, containing a full description of their patent "Integral Units" system of sectional superheaters for B. and W., Stirling, and Lancashire boilers. Many diagrams are given, including a number of sketches showing methods of removing "units," and a loose leaflet gives data from a report of a trial of a Macclesfield plant fitted with the superheater mentioned.

Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, near Stockport.—New edition of their catalogue (No. 70, 32 pages), containing an excellently illustrated description of the Mirrlees-Diesel oil engine, with notes on fuel cost, and an estimate of running costs for 100, 150 and 200-B.H.P. engines for a week of 55 hours. Some pages are devoted to engines for marine purposes, and the engines as employed in emergency electric generating sets for ships. A second publication (No. 71) describes a "Mirrlees-Diesel" oil engine supplied for Kinnaber water-works pumping plant. A third circular gives information relating to the arrangements made by the firm whereunder fuel oils may be tested and analysed in a new and specially-equipped laboratory at a stated scale of charges.

The Schniewindt Electric Co., Staniforth Street, Birmingham.—Leaflet No. 17, particularising and pricing their "Peerless" pipe-cutting pliers and wall-boring tools, intended for the use of electrical contractors, wiremen, &c.

Messrs. Carson & Evans, 3, Fenchurch Buildings, London, E.C.—Folder reprinting the opinions of a number of electrical firms respecting their experience with the use of "Carvanite" insulating material.

Messrs. Electrical Installations, Ltd., 27, Martin's Lane, Cannon Street, E.C.—Folder on "Reducing Administration Charges—How Modern Lighting Methods Affect Business."

Dowsing Radiant Heat Co., Ltd., 105, Great Portland Street, London, W.—Small folder list illustrating a new and cheap type of hot-bar radiator, and a number of luminous types and electric kettles. Prices are given, and space is left for printing in contractors' names.

The International Electric Co., Ltd., 111-115, Salisbury Road, Kilburn, London, N.W.—Supplementary section of their new telephone list (12 pages). It contains illustrations and well-arranged particulars and prices of a number of intercommunication telephones, magneto call wall telephones, railway and mining telephones, railway selective ringing telephones, and "Mercury" and "Neptune" battery calling telephones for railway and marine use.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—12-page supplementary list, D 11 (509), particularising their Simplex enclosed fuses and fuse wire. Several new types are described—including a pattern designed to take the place of the ordinary porcelain fuse carriers on standard distribution boards, having a 2½-in. break. The other types include a re-wireable pattern. It is interesting to mention that in addition to the recognised English standards the company is manufacturing fuses to the National Electrical Code of America.

Trade Announcements.—We are informed by the Edison & Swan United Electric Light Co., Ponder's End, Middlesex, that they have taken a lease of the imposing building at present occupied by the London Shoe Co., at 123-125, Queen Victoria Street, E.C. They will enter into possession shortly, when arrangements will be made for a special entrance from Upper Thames Street, for the counter trade, and other alterations will be carried out which will make the large hall a very fine electrical showroom. In the meantime, the business will, as usual, be carried on at Queen Street and College Hill, a very large stock of Royal Ediswan lamps, electrical fittings and accessories being carried at these showrooms.

Messrs. S. T. Pemberton & Co., 8, Church Street, Colmore Row, Birmingham, announce that although they have resigned the representation in the Midland Counties of the Midland Electric Manufacturing Co., Ltd., they are still interested in the manufacture of high and low-tension switchgear, and invite communications relating to same from their friends.

Mr. Norman Tegetmeier announces that his partnership with Messrs. E. C. Sparkes & Co. has been dissolved and that he has taken offices at 112, High Holborn, W.C. Messrs. Peyton & Peyton, Ltd., of Birmingham, have appointed him sole agent for the sale of their electric light fittings.

The address of the Electrical Supplies Co. is 41, Cheapside, E.C., not 4, as stated in our last issue.

Patent Applications.—An order has been made restoring patent No. 17,216 of 1909 granted to Société L'Air Liquide for an invention for "Improvements relating to the liquefaction of air and the separation of it into its constituents."

Application has been made for restoration of lapsed patent No. 4,198 of 1905 (J. H. Apjohn) for "Improvements in clutches."

Application has been made for the restoration of patent No. 5,522 of 1907 (J. Hawley, Ltd., and A. S. Jones) for "An improved electromagnetic separator drum for grain and similar conveyors."

Canadian Electrical Trade.—We are informed that the Eugene Phillips Electrical Works, of Montreal, purchased outright the entire telephone cable-making branch of the Stromberg-Carlson Telephone Manufacturing Co., of Rochester, New York. All the machinery was moved to Montreal and installed in the new quarter of a million dollar extension to the Phillips plant, which was completed a few weeks ago. The Eugene Phillips Electrical Works have been making telephone cable for about 25 years, but the addition of the Stromberg-Carlson machinery greatly increases their output.

Fire.—Considerable damage was done by fire last week to the stock and premises of Mr. A. Shaw, electrician, Storey Street, Hull.

For Sale.—Sheffield tramways department has for disposal a number of G.E. 52 motors. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Acton.—Year's Working.—Interesting figures relating to the electricity undertaking have been submitted to members of the U.D.C. this week. The statement of accounts for the year ended December 31st last shows the gross profit for the year to be £2,974 and the capital expenditure £96,229. Estimating £1,500 representing loans to the Council which had been repaid, the net capital expenditure was £94,729. The £2,974 represented 3·14 per cent. upon that sum, so that there was no amount due to the Council under Sec. 4 of the Metropolitan Electric Supply Co. (Acton District) Act of 1911. For purposes of comparison, the accountant to the Council has presented a statement showing the income and working costs per unit sold during the past year and during the year 1910-11, the last year of working by the Council. For the latter year the units sold numbered 760,696, at a cost of 3·72d., while last year 1,306,941 units were sold, the cost being only 2·57d.

The report, on being brought to the notice of the Finance Committee last week, drew from Councillor R. Poulton, J.P., the remark that it only proved what a splendid thing the Council had in the electricity undertaking, and how wrong it was to get rid of it. The chairman pointed out that the Council's best advisers told them they could not reduce the cost. Councillor Dunsmore said the statement before the meeting clearly proved, even more than he felt before, that the passing over of the undertaking to the company was an act of consummate folly. The figures were ordered to be entered on the minutes, the chairman remarking that he regarded them as being very satisfactory; and those who took an interest in the concern before it passed out of the Council's hands could not fail to be struck by the great increase in the output and the reduction in the price per unit.

Aldenham.—The P.C. has decided to ask the R.D.C. to waive the formal notices which ought to have been served in July with respect to the application of the Watford U.D.C. for a prov. order for electric light for Aldenham.

Argentina.—Our contemporary the *Review of the River Plate*, in a recent issue, gave some interesting particulars relating to the conduct of public business in the Republic, from which it seems that the Cia. Alemana Transatlantica de Electricidad has for months past been endeavouring to collect the bill of the Moron Municipality for public lighting. The bill, which was originally $37,000, now amounts to $64,000, and the company has been unable to obtain payment of a single cent, in spite of the fact that the Municipality has religiously collected the public lighting tax. The company, finding that all its attempts to collect the bill were without avail, suppressed the public lighting. The T.C. then rescinded the contract existing with the company, in spite of the opinion of the legal advisor of the Provincial Government, who said that such a course of action was impossible. At the same time it granted a concession to a company, with headquarters in the Federal Capital, who offered to donate the sum of $50,000 to the Municipality when the contract with the German company expires. It also offered to reduce the cost per month of arc lamps by $2.50 per lamp and to reduce the price for private lighting by 3 cents per KW., but insisted that the receipts for the public lighting tax should be handed over to it for collection. It is reported that the German Electric Light Co. will institute proceedings against the Municipality.

Barnes.—Electric Van Trial.—The U.D.C. has approved the action of the Public Health Committee in hiring an electrically-propelled dust van for one week at £8. In order to compete with the Gas Co., consumers making reasonable use of exterior arc lamps are to have the whole of their supply at the reduced rate of 3d. per unit, subject to the usual discounts. The Council has refused to sanction an expenditure of £50 for the purpose of advertising the E.L. undertaking.

Barnsley.—On the recommendation of the borough electrical engineer, two automatic stokers are to be purchased at an estimated cost of £300.

Barnstaple (Devon).—The chairman of the Finance Committee recently mentioned that out of £200 provided last half year against a deficiency on the electric light undertaking only £21 had been required, as the demand for current had been good and, coupled with the economy due to the new accumulators, a saving of £179 had been thus effected. A saving of £86 on the estimate, for public lighting had also been made, but no further economies in this direction were to be hoped for.

Basingstoke.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of £14,000 for carrying out the electric light scheme.

Bexhill.—Kent Coal Trial.—The Corporation has decided to purchase for experimental use at the electricity works, a quantity of Kent coal at 17s. 9d. per ton.

Birmingham.—It is reported that Messrs. L. G. Mouchel and Partners, representatives for the Hennebique system of reinforced concrete, have, in competition, been selected to design the foundations for the new electric power station at Saltley, and that the work will be proceeded with as soon as quantities are taken out and tenders obtained.

Bispham.—On October 17th the chairman of the Electricity Committee formally started a new 150-H.P. gas engine generating set.

Bitterne.—Street Lighting.—Subject to ratification by a parish meeting, the P.C. has accepted the offer of the Southamptom Electricity Committee to undertake the public lighting of the village for 10 years at £2 9s. 6d. per lamp per annum. There are to be 35 lamps.

Bolton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £5,217 for high-tension mains, conduits, &c., £2,672 for steam and feed pipes and feed tanks in connection with the new generating station at Back-o'-th'-Bank.

Bury.—An inquiry is to be held in London, on the 31st inst., respecting the question of the consent of the Lancashire Electric Power Co. to the proposed supply of electricity in bulk by the Bury Corporation to Heywood.

Cambuslang.—The police have been provided with powerful electric torches in place of the old-fashioned bull's-eye lanterns.

Canada.—Niagara Falls.—The Ontario Power Co. is seeking permission from the Queen Victoria Niagara Falls Park Commission to construct a third pipe line from its gate house on the upper river to its power house below the Horseshoe Falls. At present the company has two pipe lines, one of steel, which has been in use since the power house was put into operation, the other of concrete which was installed two years ago. Through these the company is diverting about 8,000 cb. ft. of water per second, which is approximately two-thirds the amount of water permitted to its use under the provisions of the International Treaty. By this amount of water, 12 units in the power house are operated. Providing the water is increased, the company proposes enlarging its plant to 14 units; and where now only 130,000 H.P. can be developed, the company will be able to transmit 196,000 H.P. The patents of R. O. Blainey, who assisted in the construction of the second pipe line, for a continuous concrete pipe are being investigated by the power company officials, and should they be approved, it is possible that a monolithic pipe, which will be the first of its kind in the world, will be constructed.—*Canadian Engineer.*

Carlisle.—The T.C. has decided to apply to the L.G.B. for a further loan of £534 to cover the difference between the estimated (£7,500) and actual cost (£8,034) of additional plant for the electricity works.

The Council has also reduced the charge for arc lamps for public lighting to £15 each per annum as from April 1st next. This is claimed to be the lowest charge in the kingdom.

Chester.—On Monday last, the Mayor, Mr. H. B. Dutton, formally opened the new hydro-electric plant, which was described and illustrated in our last issue.

Coniston.—Proposed Electric Light Scheme.—After a conference with Mr. C. H. Best and Mr. Pullan, both of Bradford, the Parish Council has expressed its favourable attitude towards a scheme for promoting a company to introduce electric lighting in the district. Further details are to be supplied by the promoters prior to the calling of a meeting of the parishioners.

Continental Notes.—Norway.—The A/s Glommen Pulp Manufactory has recently obtained the Government's permission to erect a new 20,000-volt transmission from Grorud to Ulverud, in Nitedal, to the north of Christiania. Permission has also been given for an increase of the pressure on the existing lines between Linderud and Grorud from 5,000 to 20,000 volts.

The Municipality of Värdalen, in the neighbourhood of Trondhjem, has quite recently decided on the harnessing of the

Uloild Waterfalls, and on the erection of a municipal electrical works in connection therewith. At the same meeting a resolution was passed to obtain a loan of £15,000 for carrying out the project.

Austria.—Speaking recently on the need for a reform of the electricity law, the Austrian Minister for Public Works stated that, notwithstanding its shortcomings, the number of generating stations in the last six years had nearly doubled and their capacity had augmented threefold. In 1912 alone 95 new installations were carried out. The number of hydro-electric works showed the greatest advance. In the last 2½ years electrical stations had risen in number from 675 to 854 (a 21 per cent. increase), and their capacity from 460,000 to 670,000 H.P., or more than 31 per cent., and the output from bulk supply stations from 320,000 to 457,000 KW., or a 27 per cent. increase. Although the difficulties were great, the Government intended to introduce and carry through this year a new electricity law.—*Zeit. Oest. Ing. und Arkt. Vereines.*

Clonakilty (Ireland).—The Urban Council has accepted the tender of the Clonakilty Lighting and Power Co. for the lighting of 50 street lamps of 50 C.P. each, for the annual sum of £100, the current to be supplied and the poles, plant and machinery to be maintained by the company. The Council is to give the company the old bridewell at a nominal rent as a power station, and the company agrees to supply householders with light at the rate of 6d. per unit. The contract is for a term of 15 years.

Cromer.—Electric Light Transfer.—The B. of T. has assented to the transfer of the electricity undertaking to Messrs. Edmundson's Electricity Corporation, Ltd.

Edinburgh.—New Plant, &c.—Estimates are to be accepted by the Electric Lighting Committee, for the extension of plant at McDonald Road, amounting to £12,000.

The Committee has agreed to lower the rate for electricity for power purposes to customers outside the city boundaries. At present the rate is 1⅜d., or ½d. per unit more than is charged within the city boundary, and in future it will be ¼d. per unit above what is charged to city consumers.

Flaxton.—Prov. Order.—The R.D.C. has decided to consent to the application of the York T.C. for a prov. order for electric lighting in the Council's area.

Fleetwood.—Application is to be made by the Council to the L.G.B. for sanction to a loan of £2,500 for electricity purposes—cable, feeder-pillar box, &c.

Glasgow.—The Electrical Exhibition at the Zoo Buildings was opened yesterday, 23rd inst., and will continue open until November 15th. A private Press view took place on Wednesday.

Greenock.—Several millowners who use water power, having in view the possibility of a shortage of power on account of the drought, are making inquiries of the electrical department, and there seems some likelihood of a change from water-power to electricity.

Hamworthy.—In order to give a supply of electricity to this parish, the Bournemouth and Poole E.L. Supply Co., Ltd., has served upon the Poole Harbour Commissioners a statutory notice for laying a cable in the fairway of the channel under the Hamworthy Bridge. The Commissioners have decided that the company has no statutory authority to lay the cable, but consent has been given to do so on condition that the company agrees to an undertaking that no claims be made upon any vessel for damage caused to any part of the cable by shipping.

Hastings.—The T.C. on October 17th decided to abolish meter rents, except in cases where an additional meter for checking purposes is installed for a consumer's own benefit, in which case there is to be a charge of 5s. per annum, and where a consumer's account for any year does not exceed £2 5s. During the last financial year the revenue from meter rents amounted to £827.

Hickleton (Yorks.).—At Hickleton Main Colliery electric safety lamps are to be substituted for the usual Davy safety lamps, and some 1,500 of them have already been procured.

Hindley.—Proposed Loan.—Application is to be made by the D.C. for permission to borrow £2,500 for the provision of a sub-station, cables, &c., for electric lighting. A L.G.B. inquiry will be held shortly.

India.—The Cape Copper Co. proposes to install electric power plant at the Rakha Hills Mine, in the Singhbhum District of Bihar and Orissa.

The Karachi Electric Supply Co. is about to erect a generating station in Karachi.—*Commercial Intelligence.*

London.—Shoreditch.—The E.L. Committee has for some time had the question of a bulk supply from the County of London Co. under consideration, arising from an offer made by the company at the time when the extension of the Council's Whiston Street works was decided on. The company's offer is for a load similar to what would be placed on the proposed new plant, with an ultimate minimum consumption of, say, 6 to 7,000,000 units per annum, ·45d. per unit, subject to a sliding scale for coal; energy to be delivered at Coronet Street works, as 10,000-volt three-phase 50-cycle current. After consideration, the Committee has adopted the borough electrical engineer's report, declining the supply, for several reasons:—Load factor not defined, but a higher load factor stipulated for than the actual load factor found in practice, which arrangement would increase the cost to the Council of producing the remainder of the supply; pressure unsuitable for interconnection with adjoining B.C. undertakings; transforming plant introduces extra charges beyond the figure quoted, and additional risks.

An interruption of supply for one hour in a considerable portion of the area of the Metropolitan Electric Supply Co. occurred on Monday evening. Apparently most of the main fuses at the Willesden generating station blew, and such an extensive failure has not occurred for about 15 years.

Japan.—A scheme is under consideration to bring about an amalgamation of all the electric lighting and tramway undertakings in the province of Kyushu. The concerns comprised in the affair are the Kyushu Electric Light Railway Co.; the Karatsu Electric Tramway Co.; the Sasebo Electric Light Co.; the Nanagawa Water Power Co.; the Daikan Electric Light Co.; and the Itojima Electric Light Co.

Keighley.—The Corporation Electricity Department is contemplating the purchase from the Manchester Corporation of a 150-KW. motor-generator for £400. The chairman of the Electricity Committee explained that the generator in question was only four years old, had not had much use, and had cost £900.

The Committee is also to obtain sub-station equipment, consisting of two switchboard panels, cubicles and metering equipment, in connection with the bulk supply of electricity to Bingley, at a cost of £258.

Manchester.—Proposed Trafford Park Power Purchase.—The Electricity Committee has requested the Parliamentary Sub-Committee to include in the proposed Parliamentary Bill the necessary powers for a new generating station, and also to include clauses to enable the Corporation to acquire the property and undertaking of the Trafford Power and Light Supply (1902), Ltd., and to generate and supply electricity in Trafford Park and the parish of Davyhulme. The Sub-Committee has decided to comply with these requests. At a meeting of the Council on October 15th, Ald. Wainwright complained that no definite figures had been given as to the acquisition of the property of the Trafford Power and Light Supply, Ltd. Councillor Dagnall, chairman of the Electric Lighting Committee, said it was not advisable to give the figures to the Council at the moment, but he would give the information to any number of the Council privately. The figures had been placed before the Parliamentary Committee and approved by it, and the Council could rest assured that the Committee was not shouldering a burden that could not be comfortably carried.

An Electrical Contractors' Association has been formed in Manchester, and at the first meeting held on October 16th, an executive committee was appointed to meet representatives of the Electrical Trades' Union, the members of which body are seeking an increase of 1d. per hour. The present rate paid is 9d. per hour.

Middleton.—On Monday a new generating set at the electricity works was formally started. Arrangements have now been practically completed with the Manchester Corporation by which Middleton will be able to supply the Rhodes branch of the Calico Printers' Association with electricity for power purposes. As previously reported in our columns, the Middleton Corporation could not supply the current required without expending a considerable sum of money upon extensions.

Moffat.—The T.C. has abandoned the scheme for lighting the town by electricity by means of water power obtained from the Well Burn, as, owing to the insufficient water power, the cost would be nearly £9,000. An alternative proposal is to be considered.

Newport.—Loan Sanction.—The sanction of the L.G.B. has been obtained to the borrowing by the Corporation of £10,772 for electricity supply purposes.

Northumberland.—Electric Winding.—The Cowpen Coal Co. is installing at the Cowpen Isabella Colliery, near Newsham, an electrically-operated winding engine to raise 150 tons of coal per hour from a depth of 900 ft., the number of trips per hour being 78. Two-deck cages are to be arranged, each deck holding two tubs, and all the decking will be performed by the winder itself, ordinary keps being utilised. The contract has just recently been placed with the A.E.G. Electric Co., and the winder will be operated on the Ward-Leonard system, supply being taken at 3,000 volts from the Newcastle-upon-Tyne Electric Supply Co.'s mains. It is stated that various improvements have been incorporated in this winder, whereby it is anticipated that the energy consumption will be extremely low, and better results will be obtained, especially when compared with machines now working under similar circumstances. This plant, which will be the first main-pit electric winder to be installed in any Northumberland pit, is expected to be in commercial service before the middle of next year.

Nova Scotia.—The Maritime Coal, Railway and Power Co. has recently decided to considerably extend the underground mechanical haulage at its Joggins Mines, and is now installing for the main haulage an endless-rope haulage gear, with rope wheel 9 ft. in diameter, operated by a motor of 250 effective H.P., the rope speed being three miles per hour. In addition to the aforementioned, six main-rope haulage gears, with motors of 25-50 H.P. and two main-and-tail haulage gears, with motors of the same size, are to be installed. The haulage gears are being made by Messrs. H. B. Wild & Co., of Birmingham, and the electrical equipment in connection with the whole of the above haulages by Messrs. J. H. Holmes & Co., of Newcastle, Mr. W. C. Mountain being consulting engineer for the scheme.

Nuneaton.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,000 for prospective expenditure on mains and services for three years.

Paisley.—Proposed Loan.—The E.L. Committee of the T.C. has recommended that application be made to the Secretary for Scotland for power to borrow £25,000, the estimated capital expenditure for the next three years.

The total is made up as follows:—Two boilers, with superheaters and other accessories, £4,000; boiler house auxiliaries and pumps, £400; 2,000 KW. of turbine generating plant, complete with condensers and pumps, £8,000; switchboards, £2,000; condensing water pumps and tanks, £500; culverts and screens for condensing water, £428; sub-station buildings, £1,200; transformers and switchgear, £1,200; mains and services, £4,000; meters, £1,000; contingencies, £2,272.

Pontefract.—Workhouse Lighting, &c.—The B. of G. has decided to obtain a supply of electrical energy for both power and light at the workhouse from the tramways company, under agreement for five years, at an all-round rate of 2½d. per unit, without restriction as to user; that metal-filament lamps be used throughout; and that the Building Committee obtain tenders for the supply of small motors and necessary fittings to drive the laundry machinery.

Pontypridd.—A successful demonstration of electric cooking, with Tricity cookers, was recently held in the town, where considerable interest has been aroused by Mr. F. S. Grogan, the well-known lecturer on this subject.

Rawtenstall (Lancs.).—Plant Extensions.—Extensions are proposed at the electricity works, Hareholme, and L.G.B. sanction is to be sought for the borrowing of £10,000. At a meeting of the T.C. on October 16th, Ald. Coupe said that £7,000 was required for additional generating plant, and £3,000 for mains extensions. In spite of the fact that they had only recently opened a large extension, the plant was already fully loaded. The new generating plant would consist of a turbo-alternator of 1,500 KW., or about 2,500 H.P., complete with condenser, foundations, pipe work, switchboard panels, and air purifier and filter. The sum of £3,000 for cables would not be spent immediately. The raising of the loan of £10,000 would not mean any additional charge on the rates, as the money proposed to be spent would earn more than sufficient revenue to cover the additional interest and sinking fund. The electricity undertaking was in a very prosperous condition.

Rothesay.—The Police Committee has recommended the T.C. to adopt an electric light and refuse destructor scheme on the lines laid down by Mr. J. A. Robertson, of Greenock. It also recommends that Mr. Robertson be appointed engineer, and that he be instructed to prepare specifications.

Runcorn.—The works of the Highfield Tanning Co., Ltd., are to be electrically equipped, and the U.D.C. has approved of the cable route submitted by the Mersey Power Co., Ltd.

Rhyl.—New Plant.—The U.D.C. has approved a recommendation that application be made to the L.G.B. for sanction to borrow £3,900. The scheme provides for an additional Diesel set of 160 KW. capacity.

Sheffield.—The Fuel, Light and Power Exhibition is being opened to-day at the City Exhibition Hall by the Lord Mayor. It closes on November 15th.

South Africa.—An electric lighting scheme is proposed for Ficksburg, Natal Province, the cost being estimated at £8,000. —*African World.*

Southend.—The T.C. has allotted £4,000 from the profits of the electricity and tramway undertakings to the relief of the rates.

Swinton.—Street Lighting.—According to a report of Mr. Busbridge, electrical engineer, the experimental electric lighting on Manchester Road by the "Barrow" system has been satisfactory, and it is now proposed to extend it all round the tramway route, using two 50-C.P. lamps on each overhead span. Mr. Busbridge states that in addition to securing better and more constant lighting than is possible with incandescent gas lamps, the cost of electric lamps is considerably less. To carry out the proposed scheme will involve a capital outlay of £1,660. If the scheme is adopted, however, and half the lamps are switched off at midnight, the estimated cost per annum is £192, as against £269 for gas alone on the present system.

Residents in the Moorside district have petitioned the D.C. for an extension of the electricity supply to that quarter.

Several applications have been received by the D.C. for supplies of electricity in various parts of Swinton and Pendlebury. Messrs. Jones & Co., Pendlebury Foundry, and Mr. S. Pollitt, Pendlebury Rope Works, are having their premises wired for electric light, and an extended use of electricity at the Industrial School is expected.

Troon.—In connection with proposals to introduce electric light, a letter was read at a meeting of the T.C. from the T.C. of Kilmarnock, stating that it had resolved to apply immediately for the extension of the area for the purpose of supplying Troon and the intervening district. Seeing that no notice had been served, the letter asked if the Troon T.C. was prepared to waive its rights in this respect. The opinion was expressed that it would be unwise to allow another authority to invade its territory before it had seen whether it could not generate electricity on more advantageous terms itself, and it was agreed to consider the further matter.

Waterford.—The cost of the electric lighting and power scheme for the city is estimated at £27,338, of which the power station will absorb £16,200, the balance being the cost of the transmission system.

Watford.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £15,150 for electricity purposes for the next three years. This will cover requirements for from 300 to 400 new consumers.

U.S.A.—The *Canadian Engineer* in a recent issue stated that the output of 303 electric supply undertakings in Great Britain in 1911-12 was 1,127,500,000 units, but Chicago alone had an annual output of over 800,000,000 units. The Chicago Edison Co. generated more energy than the local Edison companies of New York, Philadelphia, Brooklyn and Boston combined, but these companies did not supply power for local transportation, while the Chicago Co. did. [So far as the British figures are concerned, we may point out that some 300,000,000 units for railway traction are not included.]

An explosion which occurred at the Staten Island power station on Tuesday, left this district of New York in darkness and brought the electric railways and tramways to a standstill.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Lacroze Tramway Co. has applied to the Buenos Ayres Municipality for permission to construct a tramway starting in Calle Corrientes along Araoz to Warnes, from there to Constituyentes, and from there to the confines of the municipality.—*Review of the River Plate.*

Australia.—An electrically-driven street sweeping machine has just been put in service by the municipal authorities of Adelaide.

Bolton.—The Tramways Committee has ordered boxes for used tickets to be fixed on each of the tramcars.

Bradford.—The Tramways Committee has again been considering the question of the discontinuance of the Sunbridge Road-North Park Road car service, but great opposition has been expressed by shopkeepers, and it has now been decided to substitute for this service a service between Heaton and Rawson Square, which serves the wishes of the shopkeepers just as well.

The railless trolley schemes which have been dormant for a considerable time are, apparently, to be revived, 28 chassis for these trolley cars having recently been ordered by the Tramways Department. The Laisterdyke route, which was one of the first in the country, has made no big profits, but has been a valuable feeder for the tramway system. For some reason the Queen's Road route, which was prepared some months ago, has never been put into use, with the exception of one day, for the purpose of a trial of the Mercedes-Stoll car.

Bury.—A petition has been presented to the Tramways Committee asking that the time during which workpeople's tickets are available for the return journey should be extended for the benefit of people who work overtime. The manager has been instructed to obtain information from other towns and to report.

Cardiff.—The tramway employés have asked for a minimum wage for drivers and conductors of 6½d. per hour. They have also passed a resolution protesting against the long hours worked.

Cheltenham.—Local Tramway Sold.—The Cheltenham and District Light Railway (Tramway) undertaking has been disposed of to two London firms for, it is stated, between £90,000 and £100,000. The system was introduced by Mr. T. Nevins in 1901, and on his death the proprietorship passed to Mr. T. A. Nevins and near relatives.

Cleckheaton.—The U.D.C. has granted licences to the Yorkshire (Woollen District) Tramways, Ltd., to run motor-buses in the portion of the district not served by the cars, including the outlying wards of Scholes and Oakenshaw.

Darwen.—"Dinner-Hour Tickets."—The new system of granting cheap dinner-hour tickets is reported to be working very satisfactorily, and for the first 12 days, October 1st to 16th inclusive (Saturdays and Sundays excepted), the total increase of "dinner-hour passengers" is 8,480.

Continental Notes.—Austria.—A further progressive step in connection with the proposed conversion of the Vienna City Railway has been made by the announcement that the City Council has agreed to relinquish the management of the railway, so that the Ministry for Railways can proceed with the transformation scheme independently. As the expenditure on this particular work is estimated at only £2,083,000, it would probably be possible for the banking groups at the back of the Austrian electrical firms to raise the money, without troubling about an understanding with regard to the financing of the projected underground electric railways, where the participation of French capital is probably indispensable. A Vienna representative is about to proceed to Paris to conclude the negotiations respecting the latter lines.

Spain.—The Compania de los Ferrocarriles Vascongados, which owns the steam line running between Bilbao and San Sebastian, is stated by *Electron* to be studying the question of its electrification, with a view to the increased traffic which will result from through services over other companies' lines, to Oviedo, Hendaya, and the French frontier.

Germany.—A scheme for the construction of an electric tramway in the town of Gottingen, is at present under consideration.

Doncaster.—New Tramways.—The Rural Council last week received a deputation representing the Urban District Councils of Wombwell, Wath-on-Dearne, Bolton-on-Dearne and Thurnscoe, who introduced proposals of the joint Councils for application being made for an order enabling them to construct a system of tramways in the districts, and to run into the Doncaster area. The Doncaster Council passed no formal resolution on the subject, but opinion seemed to suggest that the Doncaster rural authority would support the proposals, subject to the proper protection by a clause in the order of the Rural Council and the inhabitants.

Dunfermline.—It was stated at a meeting of the T.C. last week that while in London recently, a deputation had an interview with Mr. Balfour, of the Dunfermline and District Tramways Co., with regard to the extension of the company's system to Rosyth. For road making purposes, the company is to pay £1,000 per mile for double track, and £500 for single track.

Gosforth-on-Tyne.—A serious accident occurred on the 18th inst. on the Gosforth-Wallsend route of the Tyneside Tramways and Tramroads Co.'s system, resulting in the practically immediate death of one man, and injuries to six other men, all employés of the Tramway Co. Shortly after seven o'clock a.m. a passenger car, "the Pitmen's Special," was returning empty from Gosforth to Wallsend, and when near Benton came into collision with a tour car used by the permanent way men of the company when proceeding to their work at different parts of the system. The morning was exceedingly foggy, and as each car was estimated to be going at about 10 miles an hour at the time, the impact was severe. The accident happened on the company's private tramroad, constructed on an old wagonway, so that there was no need to consider other traffic. The line is a single one, with loops, and it was expected that the passenger car would stop at a loop to enable the tour car to pass, but apparently the driver was not aware of the coming of the tour car, and the latter proceeded ahead unable to see in consequence of the fog, and seemingly unable to hear because of the noise of his own vehicle. The results of the collision were most serious. The conductor of the passenger car, William Amis, 25 years of age, who was standing on the platform beside the driver, was so seriously injured that he died within a few minutes, although medical assistance was immediately obtained. Robert Walton, the motorman of the passenger car, was very seriously injured, and has since died, while five others, also rather badly hurt, were not in such a condition as to necessitate their removal to an institution, being taken home after treatment. The fore end of the passenger car was entirely demolished; the metal front had been broken off, the electric controller had been forced through the entrance into the car, the glass had been smashed, and the controller at the rear end of the car had also been broken. The tour car was not seriously damaged. An inquest has been opened.

Halifax.—The Tramways Committee has decided to relay the track for the whole length of Commercial Street. The work will probably be undertaken in the early part of the new year.

Huddersfield.—At a meeting of the T.C. last week, Alderman Aston, presenting the minutes of the Tramways Committee, said the receipts for the past half-year had increased by £4,029, which created a record for the town. There was a surplus of £8,792, an increase of £5,077 on the same period of last year. The reserve fund for renewals was now £25,521, but a considerable portion of the track required relaying. Ten new cars were on order.

Japan.—The work of electrifying the railway between Tokyo and Yokohama is making steady progress. The road-bed is being widened to allow of four tracks—two for electric trains and two for steam trains. The power station which will supply the necessary current is being established at Kamata, the motive power will be supplied by gas engines.

Leeds.—The Halfpenny Fare.—The Tramways Committee is conducting inquiries in other towns where the halfpenny fare is in vogue. It is realised, however, that if an extended halfpenny system is to be made to pay, there must be many more cars, and new vehicles are therefore being built. It is expected that in three months' time 50 additional cars will be put on the streets.

Mr. J. B. Hamilton, general manager, reported on the progress of the tramways for the first half of the year. It was estimated at the beginning of the year that there would be an increase of £11,074 on the receipts, but this sum has already been exceeded, the total figure being £14,368. This sum has, however, been largely swallowed by working expenses, which show an increase, of roughly, £12,000. The net surplus, however, shows an increase of £37,373, as against £32,458 for the corresponding period of last year.

Liverpool.—New Type Cars.—The Corporation has recently introduced a covered double-deck bogie car with a centre entrance and platform 7 ft. long, which divides the lower body and forms two compartments. The smaller compartment seats 12 passengers, and the other seats 20 passengers, whilst the upper deck, covered throughout its length, seats 51, bringing the total seating capacity of the car up to 83. The leading feature of this car lies in the central platform, which is divided into three by swing gates mounted on the vertical hand rails. In operation the near side gates are folded back, and form division barriers. The off-side is protected by extending the gates across the opening. The two outside portions of the platform are used as exits, and the larger, or centre, portion as an entrance. By this means all passengers boarding or leaving are brought to a focus under the control of the conductor. Two separate straight stairs run parallel from the platform and open into the upper deck through vestibules, the near side stairs being an exit and the off-side an entrance, enabling the car to fill and empty simultaneously, and thus avoiding confusion and loss of time. The platform has ample accommodation for a large number of passengers to stand, allowing of the car being started without delay, and the conductor to collect the fares before the passengers disperse to the different compartments.

At both ends a compartment is provided for the motorman and control gear, with single sliding doors opening into the car body for use of the driver and conductor as occasion may arise. The flap gate or barrier is so arranged that it is a mechanical impossibility for the starting signal to be given without the flap gates first closing, and they automatically open when the car comes to a stand. The cross barrier is held by a light spring, so that a passenger may board or leave the car whilst in motion, but in doing so must deliberately push aside the barrier and therefore do so at his own risk should an accident befall him.

A new single truck car recently adopted has end platforms each 7 ft. long, and a separate entrance and exit, with two staircases running in opposite directions for ingress and egress to and from the upper deck.

The upper and lower decks of the car are fitted with a combination of transverse and longitudinal seats, having a total seating capacity of 72 (or 12 more than the present single truck car), which will make standing unnecessary.

By an alteration in the construction of the body of the car the centre of gravity has been lowered, and smoother and safer running obtained. An electrical signalling arrangement is placed on the platform, and, as soon as the car commences to move, a distinct signal is exhibited requesting passengers not to board or leave until the car stops. This is claimed to be the first real departure in the design of a four-wheel tramcar from the car designed by the late George Francis Train, more than 40 years ago.

London.—The Metropolitan Railway Co., in accordance with the understanding when it took over the management of the G.N. and City Railway, has instituted a new and accelerated service between Finsbury Park and Moorgate Street, the time on the journey being reduced to 10½ minutes.

According to the *Financial Times*, the Stepney B.C. has decided to urge the L.C.C. to obtain Parliamentary powers with a view to linking up the tramways north and south of the Thames by way of the Rotherhithe Tunnel, through which at the present time there is no passage for the travelling public.

L.C.C.—Eight trial trailer-cars have been running for some weeks under the provisional sanction of the B. of T., and in view of their success the L.C.C. will apply for powers to adapt the trailer-cars to the whole of the tramway system.

According to the *Times*, the L.C.C. is trying on the Enfield Town and Euston tramway route, a portable automatic machine, the invention of a Cologne engineer, which prints and issues numbered tickets. The machine, which weighs 4 lb., is hung on a strap worn by the conductor, and with a turn of the handle it produces a ticket clearly printed, containing the number, date, where available to and from, the time of issue, the changing point when necessary, the amount of the fare, and some of the usual regulations. In addition, the machine automatically calculates the number of tickets of each denomination issued during the day and the amount to be paid in by the conductor.

Milngavie.—A plebiscite of the ratepayers has resulted in a majority in favour of the extension of the tramway system from Glasgow.

Newcastle-on-Tyne.—New Tramways.—At a meeting of the City Council on the 20th inst., an important scheme of tramway extension was submitted, and authority was given to the Committee to promote a Bill in Parliament. The City Council had been invited by the Longbenton Urban Council to extend the city's system into its area, which lies about two miles north of the borough boundary, and this led the Tramways Committee to go thoroughly into the question of extensions, which were embodied in its present report. The report recommended that Parliamentary powers be sought to construct and work a tramway from the city boundary at Heaton to Forest Hall in the Longbenton Urban area, a distance of two miles, passing through Longbenton village to Forest Hall; another section will run from the Longbenton route into the urban area of Weetslade; a third proposal was to run motor-omnibuses generally throughout the area of the District Council either during construction of the tramways or their repair, or for the purpose of testing the demand for tramway or an omnibus service along any route or proposed route, or between any particular points. In regard to the first and second proposals, the tramway will be a single line, with passing places, to enable a five minutes' service to be maintained. The electrical energy for traction will, for a minimum period of 10 years, be obtained

from the Newcastle-on-Tyne Electric Supply Co. As to the suggested service of motor-omnibuses, it is proposed to pay the District Council a sum calculated at the rate of ¾d. per car-mile actually run upon the district roads in its area, and in consideration of this payment the District Council is prepared to give certain undertakings as to maintaining the roads in a condition fit for 'bus traffic. At the meeting of the City Council, the Chairman of the Tramways Committee moved the adoption of the report. He said the Longbenton Council had agreed to give the City Council practically a lease of 42 years, if Parliamentary powers were sought and the tramways taken into the urban district. There was a population of about 16,000 in that neighbourhood. He mentioned that the extension to Longbenton boundary, already carried out, had resulted in an increase of £80 per week in the receipts of the routes concerned. Mr. S. Easten moved that the report be sent back for reconsideration, but the amendment was defeated by a large majority, and the report was adopted.

North Staffs.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order made by them for the construction of light railways from Trentham to Newcastle-under-Lyme and Silverdale.

Warrington.—The Tramways Committee has been approached by the Winwick Asylum authorities as to the possibility of inaugurating a motor-omnibus service to Winwick.

TELEGRAPH and TELEPHONE NOTES.

Communication with Trains.—It is reported that the Midland Railway Co. has ordered an installation for communicating with moving trains, on the Railophone Co.'s system.

International Wireless Telegraphy.—It is reported from Brussels that an international company for radiotelegraphy has just been formed in that city, the constituting meeting being attended by Belgians, Englishmen, Germans, Austrians and Frenchmen. The company, which provisionally receives a subsidy of £2,000 from M. Robert Goldschmidt, general secretary of the Belgian Association of Engineers, is to carry out scientific and practical work. It is also proposed to make legislative suggestions to Governments, in order to guarantee the uninterrupted transmission of wireless telegrams according to a uniform system. The company further intends to issue regular publications, which are specially to assist the meteorological information service, and the Brussels Observatory is for this purpose to be equipped with special apparatus for wireless telegraphy.

Long-Distance Telephony.—In a lecture at Berlin last week an engineer named Riess described a new relay by which he claimed that the range of the telephone would be enormously extended; conversations over 2,000 km. could be heard with as much distinctness as those held over half that distance at present.

Postal Telegraphs and Telephones.—According to the Postmaster-General's report for 1912-13, the number of telegrams forwarded from offices in the United Kingdom was 88,494,000, a decrease of 0·7 per cent. Foreign Continental telegrams numbered 4,760,436 outward and 3,741,724 inward, the largest items being French and German telegrams. Foreign telephone calls numbered 94,073 outward and 109,054 inward, France and Belgium being the only countries concerned. On the Post Office trunk telephones there were 36,019,086 calls (including Continental), showing an increase of 7 per cent.; 3,330 circuits were in use, with 243,968 miles of wire. In London there were 244,320 telephones, an increase of 6·6 per cent., with 595,499 miles of wire; in the provinces, 486,443 telephones, an increase of 3·1 per cent., and 874,921 miles of wire. The total revenue from the telegraphs was £3,167,410, and from the telephones £5,785,701, including in each case about £53,000 as the estimated value of services rendered to other departments; the expenditure amounted to £4,124,976 on telegraphs and £5,395,627 on telephones, and there was a deficit on the former of £957,566, while the latter showed a surplus of £390,074. Redemption of capital on the telephones accounted for £1,416,523, and interest for £565,175.

Wireless in Cargo Vessels.—At a meeting of the National Seamen's and Firemen's Union in London on Saturday, it was resolved that the members should refuse to sign on ocean-going boats not equipped with wireless telegraph apparatus after May 1st, 1914.

Birmingham.—For some time past the Corporation has been at odds with the Post Office with regard to the erection of poles for telephone wires in the suburbs of the city. The P.M.G. applied to the stipendiary magistrate for power to erect the poles, but a compromise has been effected, the P.M.G. agreeing to put the wires underground in certain streets.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—November 26th. An electrically-driven storage battery industrial truck (2,000 lb.) for the Randwick workshops of the Government Railways and Tramways Department. Local representation. Specification, &c., from the office of the Electrical Engineer to the Department, 61, Hunter Street, Sydney. A copy may be seen at the Board of Trade C.I. Dept. in London.

March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices," October 17th.

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

December 14th.—Two sections switchboard, common-battery multiple. See "Official Notices" October 17th.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 26th.

Launceston (Tas.).—November 24th. Two 500-K.V.A. transformers; feeder cable, &c.; H.T. switchboard for sub-station. Specifications from City Electrical Engineer (£1 1s.). (Time extended from October 13th).—*Tenders.*

Hobart (Tas.).—December 1st. Dry cells for the P.M.G. See "Official Notices" October 17th.

Brisbane.—December 17th. P.M.G.: Insulators. See "Official Notices" to-day.

Banbridge.—November 3rd. Lighting public streets by gas or electricity for the U.D.C. Particulars at Town Surveyor's office.

Bedford.—November 12th. Corporation. (1) 1,000-KW. mixed-pressure turbo-alternator with exciter and condensing plant; (2) water-tube boiler with mechanical stoker and coal-handling plant. See "Official Notices" to-day.

Bulgaria.—Varna.—October 30th. 1,000 electric meters. Only makers to apply, and meters furnished with official certificates in the countries of origin accepted. Particulars from the Municipality.

Dublin.—November 1st. G.N. Railway Co. (Ireland). One year's supply of stores, including a number of electric and telegraph supplies. See "Official Notices" October 10th.

Germany.—Berlin.—November 11th. Imperial Post and Telegraph Administration. Telegraph posts required during the year 1914. Particulars from Telegraphen Bauburean des Reichs Postamt, 69, Mauerstrasse, Berlin, W. 66, enclosing postage (1 Mark).

Karlsruhe.—November 25th. Tenders are required for the supply of the machinery for the Murg hydroelectric station, comprising: five three-phase 5,000-K.V.A. generators and three of 350-K.V.A., with exciters; 13 transformers (110,000/10,000, 100,000/22,000, 10,000/3,000, 16,000/380/220, and 22,000/220 volts); switchboards for the power house and the Karlsruhe and Rheinau transformer stations (10,000, 20,000 and 110,000 volts); 120 km. of 110,000-volt transmission lines; 5 6,200-H.P. Francis turbines, and a 400-H.P. Pelton wheel for a fall of 133 metres, and 3 low-pressure 400-H.P. turbines; 390 metres tubing, &c. Particulars, &c. (30 Marks, returnable on submitting a tender, 25 Marks additional for plans of transmission lines, not returnable), from Grossherz Oberdirektion des Wasser und Strassenbaus, Abteilung für Wasserkraft und Elektricität, Karlsruhe.

Glamorgan.—The County Council desires to negotiate for the construction and working of five miles of light railway from Ynysforgan to Pontardawe. See "Official Notices" October 10th.

India.—October 29th. For the East Indian Railway Co.: (1) Steam turbines and condensers, &c.; (2) turbo-alternators. Specifications and forms of tender, 21s., not returnable, from the offices of the company, Nicholas Lane, Lombard Street, London, E.C.

Leith.—The Corporation Tramways Department invites tenders for the supply of a motor tower wagon. Tramways Manager, 165, Leith Walk.

London.—November 12th. L.C.C. (1) Installation at Colebrook Row Special School, Islington, N. 95 lighting points; (2) installation at County Secondary School, Chelsea, 180 lighting points. See "Official Notices" to-day.

The L.C.C. invites persons and firms, particularly manufacturers, to have their names placed on the list of those from whom tenders for supply of stores and execution of general maintenance contracts are invited by it. See "Official Notices" to-day.

Manchester.—October 29th. One storage battery, battery booster and switchboard, for the Corporation. See "Official Notices" October 17th.

Tenders are invited by Mr. Robert Carlyle, builder, Elsinore Road, Old Trafford, Manchester, for the supply and erection of two new 5-ton electric derrick cranes.

Neath.—October 28th. From 2,000 to 2,500 tons of through and through, or small steam coal, for the R.D.C. electricity works, Court Sart. Mr. G. H. Thomson, electrical engineer, 12, Green Street, Neath.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Rathmines and Rathgar.—November 4th. The Council. One 400-KW. generating set (high-speed engine direct coupled to two D.C. dynamos in tandem). See "Official Notices' October 17th.

Rhyl.—November 19th. One 160-KW. Diesel engine set, for U.D.C. See "Official Notices" October 17th.

Spain.—November 16th.—The municipal authorities of Glebe (province of Alicante) are inviting tenders for the concession for the electric lighting of the town during a period of two years.

Trowbridge.—Messrs. Samuel Salter & Co. (1913), Ltd., of Howe Mills and Stone Mills, are inviting tenders for fixing a dynamo for 115 volts, 200 amperes, 780 revolutions per minute, supplying a switchboard with about 10/12 ways, and wiring for 250 lights.

Warrington.—The electrical engineer has been instructed to obtain tenders for a supply of arc lamp carbons.

West Hartlepool.—October 27th. Corporation. Five car trucks. See "Official Notices" October 17th.

CLOSED.

Australia.—The *Australian Mining Standard* reports the placing of the following contracts:—

VICTORIA.—P.M.G.—

30 tons bronze wire, £2,593.—F. Vanderkelen & Co.

Department of Home Affairs.—

Machinery and tools for electrical workshops, Canberra, £529.—McPherson's Proprietary, Ltd.

NEW SOUTH WALES.—Metropolitan Board of Water Supply and Sewerage.—

Centrifugal pumps and electric motors, £1,900.—Zollner, Ltd.

SOUTH AUSTRALIA.—

Westinghouse brake material, £6,426.—Elder, Smith & Co., Ltd.

The Mount Morgan Gold Mining Co., Ltd., have placed orders for the supply and installation of complete switchboards, two turbo-alternators, and rotary converter of 1,500 KW., with the Australian General Electric Co.—*Mining and Engineering Review.*

Belgium.—Nine concerns—five German and two each Belgian and French—submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels, for the supply of a quantity of telegraph cables and accessories, the lowest offer being that of Messrs. J. G. Hiroux & Co., of Brussels.

Bolton.—The Electricity Committee last week accepted the tender of Messrs. Musgrave & Sons (Bolton) for the supply of air pump parts.

Bradford.—The tenders of Messrs. F. Parker & Co., Manchester; Beecroft & Wightman, Ltd., Bradford; and Jas. Rhodes & Co., Ltd., Bradford; for supplies of timber for tramcar bodies, have been accepted by the Tramways Committee.

The following tenders for supplies of machinery and equipment for the Thornbury workshops extension have been accepted by the Tramways Committee:—

Tangyes, Ltd. (Birmingham).—Armature winding machine, £88; and wheel-turning lathe, £808.
Leeds Engineering Hydraulic Co., Ltd.—Two sets hydraulic jacks, £230.
Jas. Keith & Blackman Co., Ltd.—Smiths' hearths (two single and one double), £81.

The chairman and deputy chairman and the general manager were authorised to purchase a suitable punching and shearing machine.

The Tramways Committee has recommended the purchase of 20 Dick-Kerr standard 40-H.P. motors, at £104 each, as special motors for use on cars on the through service between Bradford and Leeds.

Canada.—MONTREAL.—The *Canadian Engineer* states that the contract for the electrification of the Mount Royal tunnel has been awarded to the Canadian General Electric Co.

Carlisle.—The T.C. has accepted the tender of the Union Electric Co., Ltd., of London, for two motor-alternators, complete with switchgear, at £900.

Cleethorpes.—Messrs. Chamberlain & Hookham, Ltd., have received the Council's contract for prepayment meters.

France.—The French Post and Telegraph Authorities in Paris last week gave out contracts for the supply of lead-covered telephone cable, as follows:—Messrs. Grammont, of Pont-de-Cherny, one lot of 10 km., with 28 pairs of silk and cotton-insulated conductors; the Société Industrielle des Telephones, of Paris, one lot ditto, and one lot of 15 km. of cable, with 14 pairs of conductors; the Ateliers de Construction Electriques du Nord et de l'Est, of Jeumont (Nord), one lot of 10 km. of 28 pair conductor cable; La Société Materiel Telephonique, of Paris, one lot of 10 km., with 28 pairs of conductors, and one lot of 15 km., with 14 pairs of conductors; and the India-Rubber and Gutta-Percha Co., of Persan (Seine et Oise), one lot of 15 km., with 14 pairs of conductors.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.)

CROWN AGENTS FOR THE COLONIES.

Train-lighting dynamos.—Mather & Platt, Ltd.
Electrical equipment for wagon turntables.—Craven Bros., Ltd.
Insulators, &c.—Siemens Bros. & Co., Ltd.
Electric fans.—British Westinghouse Electric and Manufacturing Co., Ltd.
Telegraph poles.—Siemens Bros. & Co., Ltd.
Telephone switchboard.—Siemens Bros. & Co., Ltd.
Telephones, &c.—British L.M. Ericsson Manufacturing Co., Ltd.
Copper wire, &c.—Elliott's Metal Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Accumulators.—Tudor Accumulator Co.
Cables.—London Electric Wire Co. and Smiths.
Dynamo.—Laurence, Scott & Co.
Fans.—Crompton & Co.
Motors.—Lancashire Dynamo, &c., Co.
Searchlight plant.—Lancashire Dynamo, &c., Co.
Switchboards.—Eckstein, Heap & Co.
Wire.—Elliott's Metal Co.; R. Johnson & Nephew; W. Bain & Co.

GENERAL POST OFFICE.

Manufacturing, supplying, drawing in and jointing a cable between Liverpool and Birmingham.—B. I. and Helsby Cables, Ltd.
Manufacturing, supplying, drawing in and jointing a cable between London and Birmingham.—Western Electric Co., Ltd.
Telephone exchange equipment, Aberdeen, Brixton, Chester and Dudley.—Western Electric Co., Ltd.
Telephone exchange equipment, Accrington and Portsmouth.—Automatic Telephone Manufacturing Co., Ltd.
Telephone exchange equipment, Grimsby, Lowestoft and Stockport.—Siemens Bros. & Co., Ltd.
Telephone exchange equipment, Romford.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; London Electric Wire Co., and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Sterling Telephone and Electric Co., Ltd.
Testing apparatus.—Evershed & Vignoles, Ltd.
Telegraphic cable.—Callender's Cable and Construction Co., Ltd.
Telephonic cable.—B.I. & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Insulators.—J. Bourne & Son; Doulton & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.
Metallic-filament lamps.—Edison & Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.
Bronze wire.—T. Bolton & Sons; Shropshire Iron Co., Ltd.
Galvanized iron wire.—Whitecross Co., Ltd.

H.M. OFFICE OF WORKS.

Incandescent electric lamps.—Dick, Kerr & Co., Ltd.; Maxim Lamp Works, Ltd.; Pope's Electric Lamp Co., Ltd.

H.M. Office of Works has placed a contract for three years' supply of fuseboards and distributing switch and fuseboards in cast-iron and teak cases with Messrs. Drake & Gorham, Ltd.

Hereford.—The contract for the complete installation at the Picture House, Berrington Street, has been placed with Messrs. Walker & Co., of Hereford.

Keighley.—Messrs. Clough, Smith & Co., Ltd., London, have secured from the Corporation the contract for the erection of the 6,600-volt high-tension transmission line between Keighley and Bingley, at £734.

Leighton Buzzard.—Messrs. Francis Reade & Co., of Finchley, have just completed the entire installation at the Grand Theatre, Leighton Buzzard. Current is generated by a plant consisting of a Crossley gas engine and dynamo.

Littleborough.—The Electricity Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works, Ltd., for the laying of cable from Victoria Street to Joseph Street.

Maidstone.—The Corporation has given an order for switchboard extension to Messrs. Drake & Gorham, Ltd.

Malvern.—The U.D.C. has accepted the tenders of Messrs. Wilesmith & Son and the South Wales and Cannock Chase Coal Co. for the supply of from 350 to 400 tons of coal for the electricity works.

New Zealand.—The Christchurch Municipal Council has accepted the tender of Messrs. Turnbull & Jones for converters in connection with the Lake Coleridge hydro-electric supply scheme.—*Tenders.*

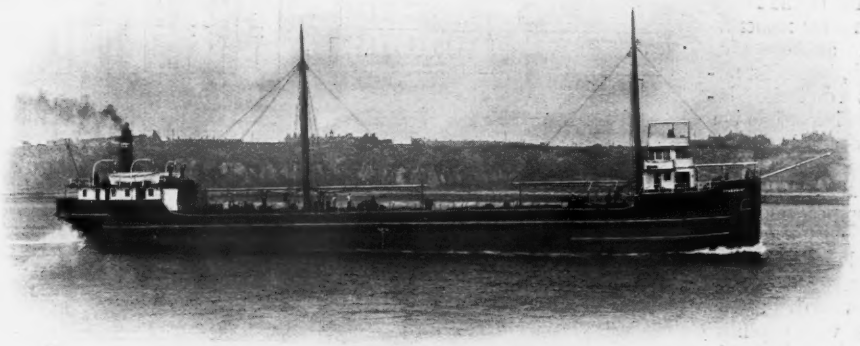
(*Continued on page* 666.)

THE ELECTRICALLY-PROPELLED CARGO VESSEL "TYNEMOUNT."

On several occasions we have published particulars of the vessel which has been under construction on the Tyne for service on the Canadian canals and lakes, and which is the first important example of an electrically-propelled cargo vessel built in this country.*

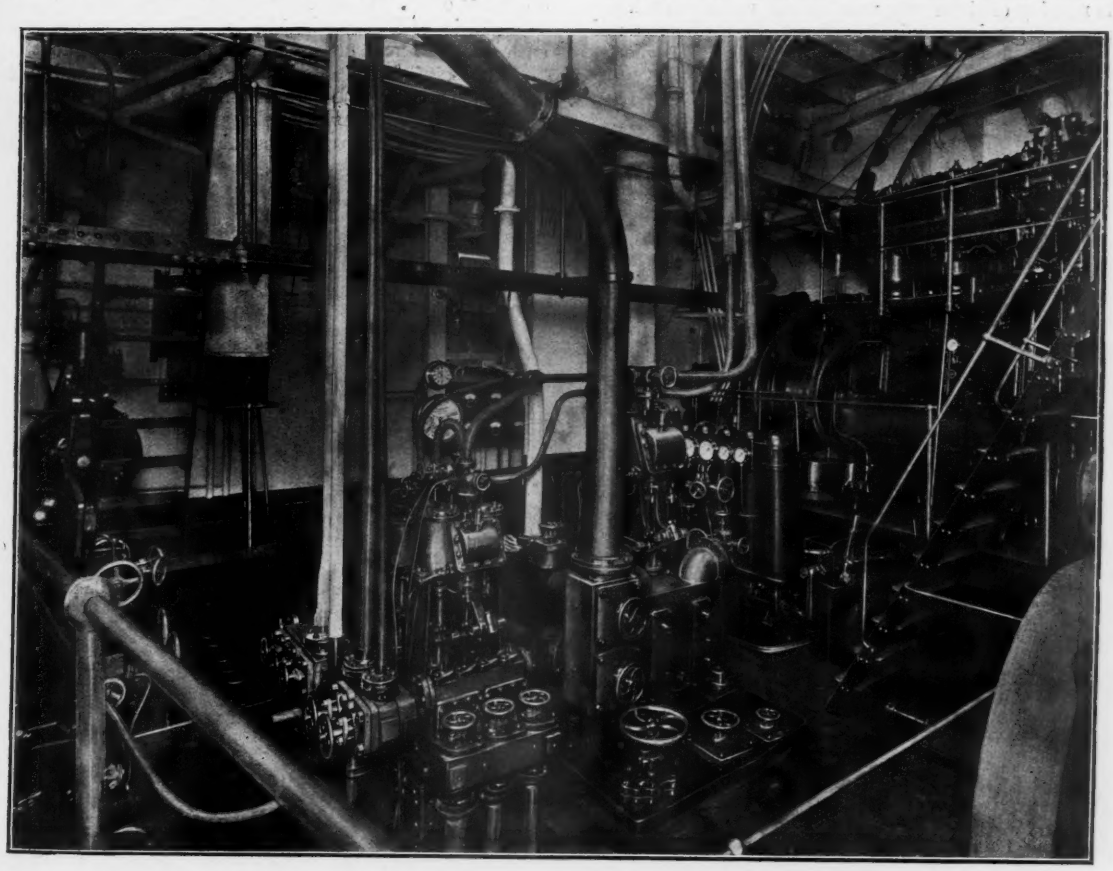
We are now enabled by the courtesy of the Electric Marine Propulsion Co., Ltd., to whose order the vessel has been built, to reproduce a number of photographs of the machinery, and to give a description of the installation in its final form.

The system of electric drive is that designed by Mr. Henry A. Mavor, who has described the system and discussed its advantages in papers before several societies.



The "Tynemount."

This system has for its special object the simplification of the electric equipment. Many applications of electric power have been made to marine propulsion, but hitherto, with the exception of the *Electric Arc*, propelled on this system and built in 1911, and the U.S. ship *Jupiter*, continuous currents only have been used, the reason being that regulation of speed and control is easier for continuous current under ordinary conditions than for alternating current. The disadvantages attached to the use of alternating current in respect of regulation are associated with the greater number of conductors, and particularly with the property of A.C. motors, that the speed of the motor bears a fixed ratio to the speed of the generator, and that any departure from this speed is associated normally with loss of efficiency and with more or less complicated devices for changing the frequency.



View of the Engine Room, Starboard Side, Showing one Generating Set.

In the system under notice these difficulties are overcome by the use of more than one frequency applied to each individual motor. The currents of different frequency

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* Electrical Review, September 22nd, 1911; September 20th, 1912; and September 26th, 1913.

are carried in independent mutually non-inductive circuits, the magnetic systems being entirely independent, but operating upon a common rotor, so that their mechanical effects can be superposed and the power transmitted in the separate circuits combined to produce the required mechanical effect. The required currents may be obtained from one or more generators.

The method of control entirely dispenses with the stopping and starting of the Diesel engines for manœuvring, an operation which, in itself somewhat difficult, becomes impossible if a liberal supply of compressed air be not available. To keep up a supply of compressed air for manœuvring a vessel in the locks and channels of a canal involves the upkeep of a very expensive and inefficient air-compressing plant, and the dispensing with this auxiliary is a very important feature of the system. It is also advantageous to have two units, each capable of driving the ship, so that in the event of any interruption to the running of either, the vessel is still under control.

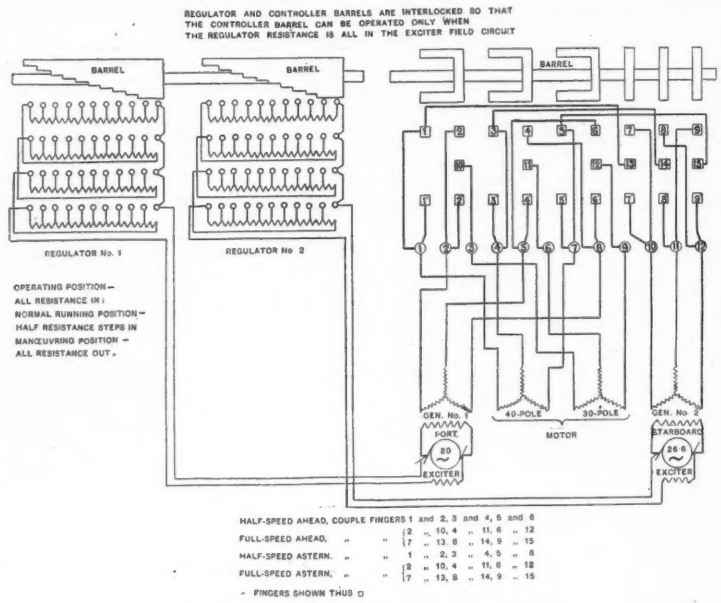

REGULATOR AND CONTROLLER BARRELS ARE INTERLOCKED SO THAT THE CONTROLLER BARREL CAN BE OPERATED ONLY WHEN THE REGULATOR RESISTANCE IS ALL IN THE EXCITER FIELD CIRCUIT
BARREL
BARREL
BARREL
REGULATOR No. 1
REGULATOR No 2
OPERATING POSITION — ALL RESISTANCE IN ;
NORMAL RUNNING POSITION — HALF RESISTANCE STEPS IN
MANŒUVRING POSITION — ALL RESISTANCE OUT .
GEN. No. 1 PORT.
40-POLE
30-POLE
MOTOR
GEN. No. 2 STARBOARD
20
EXCITER
26·6
EXCITER
HALF-SPEED AHEAD, COUPLE FINGERS 1 and 2, 3 and 4, 5 and 6
FULL-SPEED AHEAD, " " 2 " 10, 4 " 11, 6 " 12 / 7 " 13, 8 " 14, 9 " 15
HALF-SPEED ASTERN, " " 1 " 2, 3 " 4, 5 " 6
FULL-SPEED ASTERN, " " 2 " 10, 4 " 11, 6 " 12 / 7 " 13, 8 " 14, 9 " 15
- FINGERS SHOWN THUS □

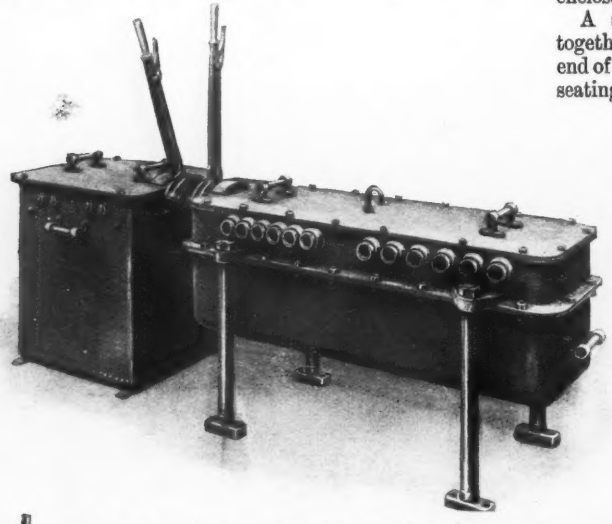
Diagram of Electrical Connections.

The vessel has been built by Messrs. Swan, Hunter and Wigham Richardson, Ltd., of Wallsend, and is 250 ft. in length by 42 ft. 6 in. beam and 19 ft. depth moulded. It has two masts ; there is one steel deck, and three cargo holds, with seven large hatches. On the deck are steam winches for working the cargo with three 3-ton derricks ; there is also a steam windlass and steam-steering gear. Electric light is fitted throughout. The auxiliary machinery is supplied with steam from two Cochran donkey boilers fired by means of oil fuel.

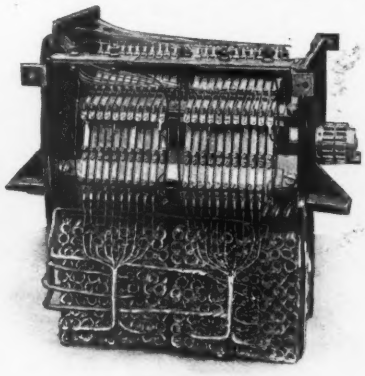
The vessel has a double bottom throughout, adapted for carrying water ballast and oil fuel. There are also two tanks for oil fuel on the deck.

The machinery is accommodated right aft under the poop. The prime movers of the installation consist of two six-cylinder high-speed engines of the well-known "Mirrlees-Diesel" type, as manufactured by Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, near Stockport. They are each capable of developing 300 B.H.P. at 400 R.P.M. on the four-stroke cycle, the diameter of the cylinders being 12 in. and the stroke 13½ in. The engines are totally enclosed, and forced lubrication is employed throughout.

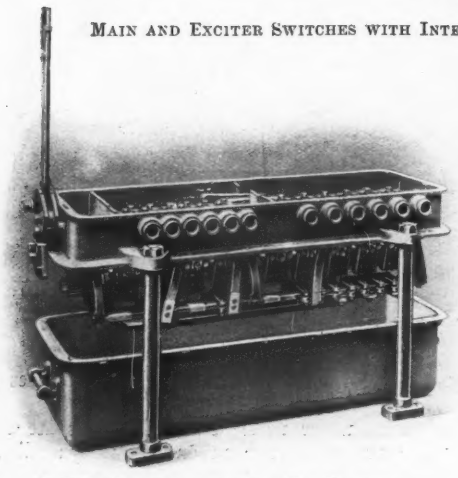
A substantial bedplate, cast in two pieces and bolted together, joins with the alternator bedplate at the fly-wheel end of each engine, the whole being secured to the raised engine seatings, which form part of the ship's structure on both port



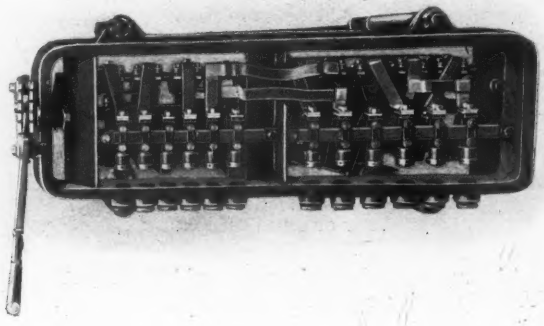
Main and Exciter Switches with Interlocking Gear



Exciter Switch Removed from Case.



Main Switch, with Tank Lowered.



Main Switch in Plan.

and starboard sides of the engine room. The six cylinders of the engine are divided into two groups of three cylinders each, the vertical shaft which drives the cam shaft being placed between the two groups. The crankshaft is made in two pieces, the gear wheel which transmits the motion to the vertical shaft being bolted between the two flanges of the central coupling, and these flanges are turned solid with the shafts.

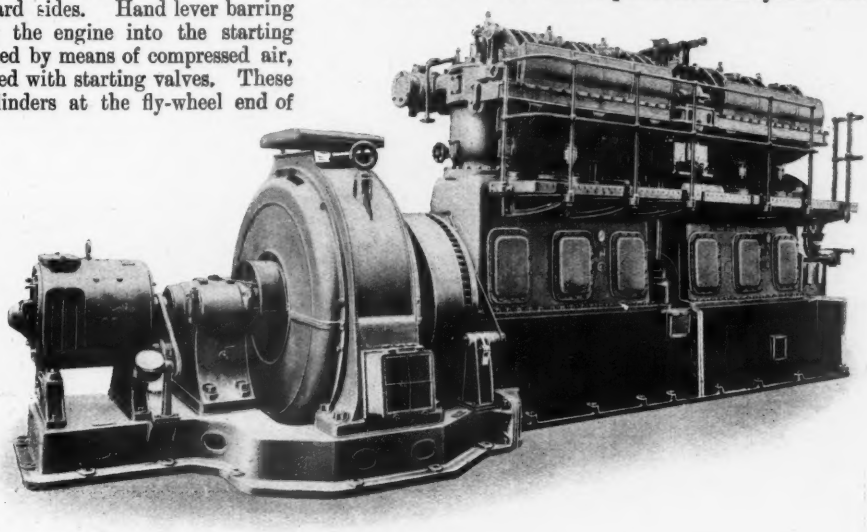
The engines, which are coupled to the alternators in the usual manner, are placed at the forward end of the machinery space on the port and starboard sides. Hand lever barring gear is provided for turning the engine into the starting position. Starting is effected by means of compressed air, three cylinders only being fitted with starting valves. These are arranged on the three cylinders at the fly-wheel end of the engines, and their operation is rendered easy for the engineers in charge by a system of bell crank levers and coupling rods, transmitting the motion from a control pillar placed on the engine room floor in close proximity to the air receivers of the engines. A device for stopping the engine and means of controlling the amount of air delivered by the air compressor are also provided on the same control pillar. Near at hand is the electric controller of the transmission system, the whole providing a compact and centralised arrangement for the operation of the propelling machinery.

At the after end of each engine a three-stage air compressor is fitted, direct driven from an extension of the engine crankshaft. This extension also provides means for driving the lubricating and circulating water pumps.

The two groups of cylinders comprising each engine are carried by two enclosed-type columns, each cast in one piece and provided with inspection doors of ample size. To these columns on the front or cam-shaft sides of the engines, cast-iron brackets are fixed which support grating platforms running along the whole length of each engine on the front side; these platforms provide easy access to the valve-gear and valves.

The valves are situated in the cylinder covers, the fuel valve being of the ordinary needle type opening vertically upwards; the exhaust and air valves open downwards, and all are operated by cams and levers in the usual way.

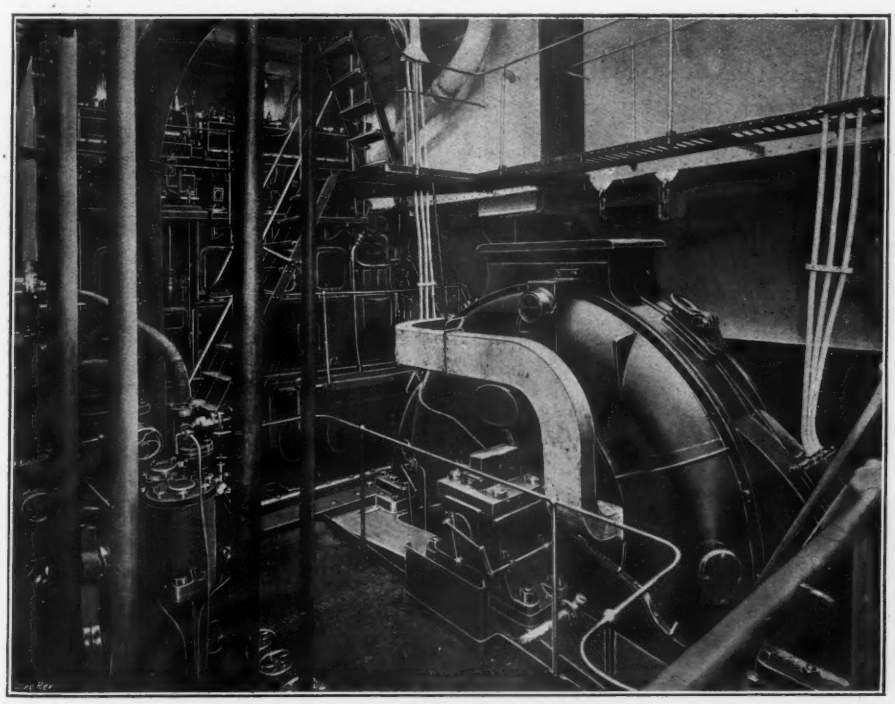
An important feature of these levers is the provision of a hinged and bolted joint in each, which allows, by the undoing of one bolt, any lever to be folded back, and by this means the work of withdrawing the valves is reduced to a minimum. All the valve seats are made separate from the cylinder covers, and can be withdrawn bodily with the valves. Spare valves and seatings are carried, and thus all grinding-in can be done on the bench at the engineer's convenience.



One of the 300-b.h.p. Diesel Electric Generating Sets on the "Tynemount."

The pistons are of the trunk pattern, and have separate heads, and the top ends of the connecting rods are fitted with gun-metal bushes working on case-hardened piston pins.

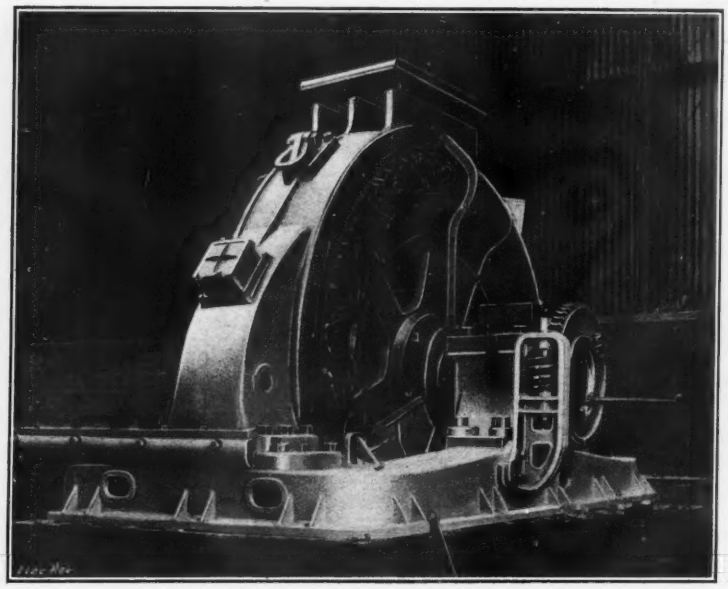
The fuel pumps for delivering oil to the cylinders are situated on either side of the vertical shaft gear-casing, and are driven by eccentrics from the camshaft. Each of these eccentrics operates a small crosshead, to which are fitted the three plungers of each pump. Fuel oil is fed by gravity to the fuel-pump suction chamber from the ready-use tanks, which are situated on the forward bulkhead of the engine room. The amount of oil passing through the cylinders is determined by the governor, which is fitted on the upper portion of the vertical shaft; a system of coupling rods and levers is connected from the governor arm to a small spindle passing through the fuel-pump suction chamber, and to this spindle tappets are fixed which determine, according to the position of the governor, the length of time the fuel-pump suction valves remain off their seats, and until the suction valves are closed no oil will be delivered to the fuel valves on the cylinder covers.



View of Engine Room, Looking Aft, Showing Propeller Motor.

The circulating water after passing through the engines

goes to the exhaust pipes, which are water-cooled. From thence it passes from each engine through a water-flow indicator into a branch piece from which two pipes are led, one pipe going to the discharge valve on the ship's side, and the other by means of a by-pass to the suction side of the circulating pump. By this means warm water can be mixed with the incoming water from the weed traps when the ship is sailing in cold waters. When the ship is running in fresh water, it will be possible by means of a special arrangement to pass the hot circulating water from one engine into the feed tank of the donkey boilers. When the engines have been stopped and are cooling down, it has been arranged that the sanitary pumps may pass circulating water through them and thus lessen the chances of precipitation of salts or alkaline matter in the jackets.



Motor with Guard Plate Removed, Showing Windings.

The electrical equipment consists of two Mavor & Coulson three-phase alternators, each direct coupled to one of the Diesel engines. The alternators when running at their normal speed of 400 r.p.m. each give an output of 270 amperes at 500 volts per phase, which absorbs the full power of the engine. They are provided with six and eight poles respectively, making the frequency of the current 20 periods per second, and 26·6 periods per second respectively.

An exciter is direct-coupled to each alternator, and is capable of giving an exciting current of 30 amperes for normal working, which can be increased up to 50 amperes whilst manœuvring.

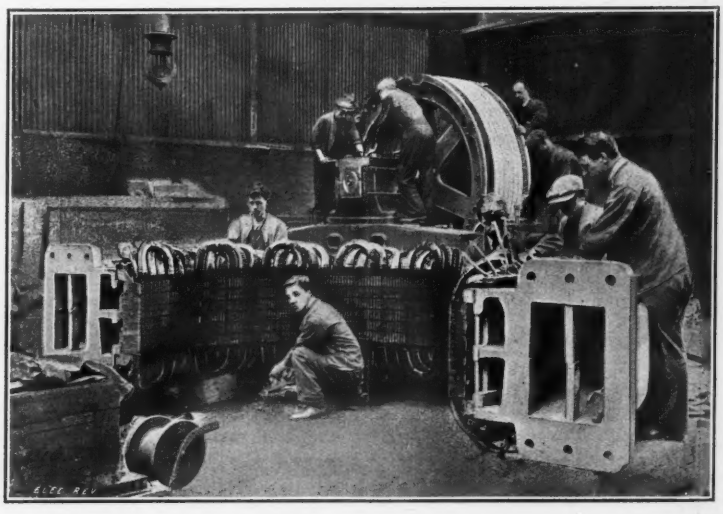
The current from these two generating sets is led to a 500-b.h.p. Mavor & Coulson patent induction motor of special construction.

The rotor of this motor is of the squirrel-cage type, but the stator is provided with two different and entirely separate windings, one of 30 and the other of 40 poles. When these two windings are supplied with current at 20 and 26·6 periods respectively, they give the same synchronous speed of 80 r.p.m. The motor will then absorb the full power of both engines and drive the propeller, to which it is direct coupled, at a speed of 78 r.p.m. This propeller speed corresponds to the fastest speed of the vessel.

In order to obtain a slower speed the connections are altered so that the alternator, giving 20 periods, supplies the 40-pole winding of the motor; the alternator giving 26·6 periods can be shut down and the 30-pole winding of the motor is also out of use. The synchronous speed of the motor with the propeller is now reduced to 60 r.p.m. One of the engines only is available, but as the speed of the ship is reduced to about three-quarters of the normal, half of the total h.p. is ample, and the great advantage is obtained of being able to shut down entirely that part of the plant which is not required at the low speed. It will be noted that the two alternators, when both are at work, are connected to entirely separate circuits, and they are, therefore, never run in parallel. The paralleling of two alternators, necessitating that they should be run up to speed and synchronised before being switched on to the load, is quite unsuitable for ship work; this operation not only requires skill and care, but would involve considerable delay in starting the propeller motor. The motor is readily reversed by interchanging the connections of two of the phases.

The switchgear by means of which the necessary changes of connection are made, is extremely simple; it consists of two parts:—A main switch of the tramway controller type having five different positions, "full ahead," "half ahead," "stop," "half astern," "full astern"; and a second switch, the purpose of which is to introduce resistance into the shunt circuit of the exciter.

The contacts of both switches work under oil, but it is inadvisable that the contacts of the main switch should be required to break the large main current flowing to the motor. The two switches are therefore interlocked so that it is impossible to work the main switch except when all the resistance has been introduced into the exciter field coils. There is then practically no excitation, and the whole system is "dead." With the resistance in the exciter field circuit, the main switch can be moved to any one of its four working positions, and when the main connections have been made for the new running position, the shunt switch lever is pulled over so as to cut out the resistance and restore the excitation. Until the main switch is definitely on one set of contacts, the shunt switch is locked, so that the excitation cannot be restored. A diagram of the connections is shown on page 662.

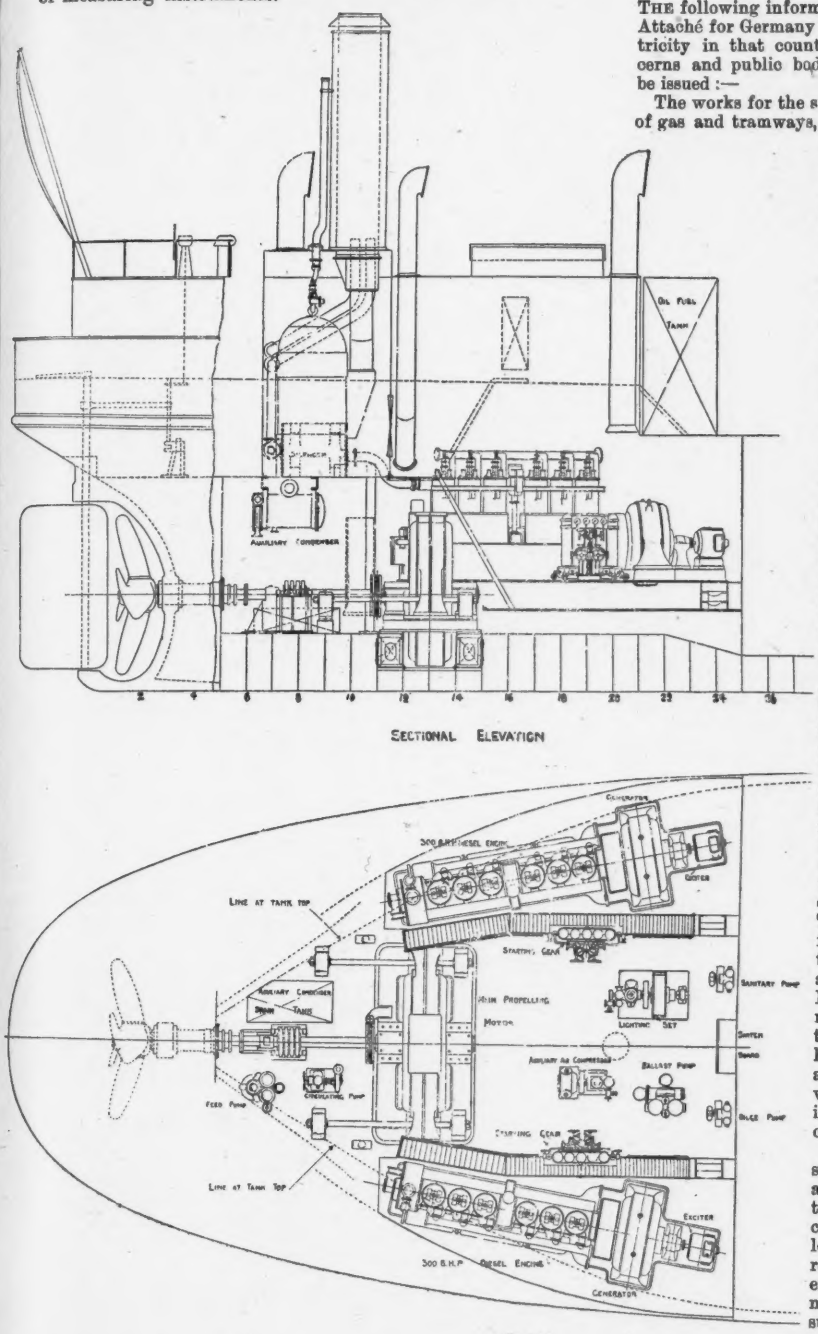


Stator of Propeller Motor under Construction.

It will be seen that the whole handling of the ship can be carried out by means of two levers which are so interlocked as to be practically fool-proof. In the present instance these switches are in the engine-room, but it is evident that by lengthening the connecting cables they could be placed on the navigating bridge.

The number of electrical instruments provided has been kept down to a minimum. There are provided only one

ammeter and one voltmeter for each alternator, and an ammeter and voltmeter for each exciter. The handling of the switchgear is so simple that there is no necessity for multiplication of measuring instruments.



Arrangement of Generating Sets and Propelling Motor on the "Tynemount."

The electrical drive permits the speed of the ship to be altered without altering the engine speed. It also permits a convenient gear ratio to enable the engines and the propeller respectively to be run at their most efficient speeds, and provides for the ready reversal of the propeller while the engines continue to run in their normal direction.

In addition to the above advantages, it is found that in many cases the system will allow of a reduction in the machinery space, and also in the bunker space required, thus increasing the cargo capacity of the vessel. As a subsidiary advantage, it lends itself readily to distant control, and in any case where it may be found advisable, the switchgear can be put on the bridge and the control of the motor driving the propeller placed in the hands of the navigating officer.

It is anticipated that, compared with a mechanically-geared or direct-connected Diesel-engine equipment, the electrical equipment will offer very material advantage in the operation of the vessel in the special circumstances under which it is placed.

MUNICIPAL ELECTRICAL ENTERPRISE IN GERMANY.

The following information is from a report by H.M. Commercial Attaché for Germany (Sir F. Oppenheimer), on the supply of electricity in that country by the chief works in which private concerns and public bodies are jointly interested, which will shortly be issued :—

The works for the supply of electricity, like those for the supply of gas and tramways, were, in Germany, at first purely private ventures. Though owned by private companies, these enterprises partook of the character of monopolies—not necessarily legally secured. The rights of these companies rested upon concessions which, owing to the inexperience of municipal bodies, tended to work greatly in favour of the companies. In consequence, there followed a period of reaction in favour of municipal trading. It was hoped that these quasi-monopolies would thus be converted into a source of profit to the municipality, and that the interests of the consumers would, at the same time, be more thoroughly safeguarded against the high-handed methods sometimes adopted by the private companies.

Within recent years, however, opinions concerning more especially the supply of electricity have undergone further changes; at present the tendency is all in favour of a combined system, under which the enterprises are managed by a private company, in the working of which the interest of the community, as such, is safeguarded by a participation in the capital and in the management of the company. This combined system has found favour with the municipalities and the companies alike.

The municipalities admit that a purely public enterprise, municipally managed, has been found too inelastic to move as rapidly as modern circumstances of trade and industry may require; that the best managers cannot be secured among municipal officials with only municipal pay; that the town councils as controlling bodies show a lack of technical understanding; that the expected profits have failed to realise because the rate of charges had to be unduly lowered in deference to the demands of the people's representatives, or because wages had to be unduly increased. The profits under public management were further curtailed by unavoidable concessions to the public of unprofitable lines, low tariffs, a certain luxury in the rolling-stock, &c. In the case of the supply of electric power more especially, a great freedom in negotiating contracts with important consumers has proved essential; hard-and-fast tariffs are impracticable, because large consumers, whom it is essential to secure, demand an individual treatment which necessitates discretion.

More important than these is the consideration that electrical works, for technical and economic reasons, must aim at supplying the largest possible area—for thus alone can electric power be profitably supplied at low rates—so that in many cases a stage is reached where the system ought to be extended beyond the boundaries of the municipality. Technically, the supply of such vast areas has become possible only within a comparatively recent period; nothing, in fact, has tended more thoroughly to undermine the traditional ideas as to the advantages of municipal trading so far as the supply of electricity is concerned. It is also a notorious fact that the smaller communities prefer entering into contracts for the supply of light, power, &c., with private concerns rather than with their larger neighbours, of whom they are both jealous and suspicious.

Occasionally, too, cases have occurred in which municipalities have, for financial reasons, favoured an enterprise under private rather than under municipal management; they shirked the necessity of increasing their debt because they suspected that the Central Government would not give the necessary consent to increased borrowing.

Occasionally, too, the force of circumstances has led communities to consent to a combined private enterprise; they had hesitated too long in extending the area of their own works, and when they wished to expand they found that private companies were too firmly established outside their very gates to abandon the field on reasonable terms.

Private companies have favoured a combined working for a variety of reasons, quite apart from any considerations which may prompt (*a*) firms manufacturing electro-technical appliances, or (*b*) mining concerns with the necessary supply of coal, lignite or power, to take a share in electrical works.

The chief inducement for private concerns to work electrical enterprises with a municipality as a partner is the greater facility then afforded of financing enterprises of the necessary modern dimensions. Municipal credit, which is cheaper than private, can help them, for example, in the following different ways :—

1. The municipalities guarantee the loans necessary for the mixed works, and this results in an easier issue and a lower rate of interest. Thus a large share of the necessary capital can be procured by way of loans, and the issued share capital remains low and yields a higher return.

2. The municipalities themselves effect the loans and place the capital thus procured at the disposal of the common enterprise.

3. Municipalities purchase or build with their own issues, tramway lines, small gauge lines, &c., and subsequently leave their management to mixed works.

4. The municipalities reserve the right to take over a part of the share capital of the mixed works.

Again, it is notorious that many advantages, especially from official quarters, can be more easily obtained if the works are mixed rather than private—not only from the municipal authorities themselves, but also from the district or provincial authorities, *e.g.*, in connection with the use of roads, thoroughfares, &c.

Force of circumstances has again at times prompted the scheme of mixed concerns, cases in which the combined working is the result of a compromise. Repeatedly the field was found no longer free for a private venture ; there were municipal works, however inefficient, already in existence which were used as a start. Municipalities, moreover, were disinclined to give up the use of their streets and thoroughfares to a private company without a certain municipal control in the enterprise.

CONTRACTS CLOSED.

(*Continued from page* 660.)

London.—The Langdon-Davies Motor Co. have received the annual contract from the General Post Office for the supply of A.C. motors for 1913-14.

L.C.C.—The following tenders have been received by the L.C.C. for electrically lighting two schools :—

Royal Hill School, Greenwich—

Arthur Newman, Ltd.	(accepted)	£148
C. H. Cathcart & Co.		165
Alpha Manufacturing Co.		172
Cunningham, Ltd.		174
G. F. Ratcliff & Co.		334
A. J. Howens		881

Middle Row School, Kensington—

Arthur Newman, Ltd.	(accepted)	£460
W. Mackie & Co.		471
H. J. Cash & Co., Ltd.		479
G. E. Taylor & Co.		492
E. Lawrance & Sons, Ltd.		570
G. F. Ratcliff & Co.		699

The L.C.C. Fire Brigade Committee reports that J. C. Braun, Premier-Werke, A.G., Nürnberg, having gone into liquidation, have notified their inability to supply the petrol-electric chassis for an escape van ordered from them at £930. The offer of Magirus, Ewald und Lieb to supply two Magirus ladders, for £1,200, has been accepted, and the offer of Cedes Electric Traction, Ltd., to supply, for £2,200, two petrol-electric chassis for fitting to Magirus ladders, and the fitting of the chassis to the ladders, has been approved. The contract for the engines is to be sublet to J. Tylor & Sons.

Sheffield.—The City Council has accepted the tender of the Electricity Department to wire the Brightside baths at about £38 17*s*.

South Africa.—The South African Railways and Harbours Administration has accepted the tender of the A.E.G. Electrical Co., of South Africa, Ltd., for the supply of 36,000 train lighting lamps to specification, and those of Orenstein-Arthur Koppel, Ltd., for the supply of 10 miles of train track, 24-in. gauge, 16-lb. section, complete with sleepers and fastenings, and 150 side-tipping trucks.—*African World.*

Stafford.—The contract for the installation of the new building for the Stafford Co-operative Society has been received by the Mechanical and Electrical Engineering Co., of Walsall.

Walthamstow.—The T.C. has accepted the tender of J. Baker & Co. for a supply of a dozen special tramcar axles, at £3 3*s*. per axle, and that of W. T. Henley's Telegraph Works, Ltd., for feeder cable.

Warrington.—The tender of the St. Helen's Cable and Rubber Co., Ltd., has been accepted by the Electricity Committee, at £171, for the supply of three sets of tires, with 1,200 miles guarantee.

The Corporation switchboard extension contract has been awarded to Messrs. Drake & Gorham, Ltd.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 24th. At 5 p.m. At the Imperial College of Science, Imperial Institute Road, South Kensington, S.W. Papers on "The Ice Calorimeter," by Mr. Ezer Griffiths, B.Sc.; "An Electrostatic Oscillograph," by Messrs. H. Ho and S. Koto.

Institution of Mechanical Engineers.—Friday, October 24th. At 8 p.m. Paper on "Modern Flour Milling Machinery," by Mr. R. B. Creak.

Manchester Association of Engineers.—Saturday, October 25th. At "Masonic Room," Grand Hotel, Aytoun Street, Manchester. Paper on "Engineering Workshop Organisation," by Mr. Hans Renold.

Institution of Electrical Engineers (Western Section).—Monday, October 27th. At 3.30 p.m. At Merchant Venturer's Technical College, the University, Bristol. Address by Mr. H. Faraday Proctor, chairman. At 11.30 a.m. Visit W. D. & H. O. Wills, Ltd., factory. At 7 p.m. Annual Dinner at Royal Hotel, College Green.

Institute of Marine Engineers.—Monday, October 27th. At 8 p.m. Discussion on Fuel Test.

Association of Electrical (Station) Engineers.—Tuesday, October 28th. At 7.30 p.m. At Chandos Hall, Maiden Lane, London, W.C. General meeting.

Wednesday, October 29th. At 8 p.m. At the Old George Hotel, Briggate, Leeds. General meeting.

Thursday, October 30th. At 7.30 p.m. At the School of Technology, Manchester. Paper on "Scientific Measuring Instruments," by Mr. T. S. Wallis.

Association of Mining Electrical Engineers.—Saturday, October 25th. At 4.30 p.m. At Royal Technical College, Glasgow. Joint meeting with National Association of Colliery Managers. Paper on "Power Transmission," by Mr. W. H. Telfer.

Batti-Wallah's Society.—Friday, October 31st. Smoking concert.

Greenock Electrical Society.—Friday, October 31st. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "The Principles of the Steam Engine," by Mr. J. Frew; and "Boiler Inspection," by Mr. G. R. Reid.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 31st. At 7.30 p.m. At Bolbec Hall, Newcastle-on-Tyne. General meeting.

Junior Institution of Engineers.—Friday, October 31st. At 39, Victoria Street, Westminster.

Salford Technical and Engineering Association.—Saturday, November 1st. At 7 p.m. At Royal Technical Institute, Peel Park. Short Papers.

NOTES.

The Royal Mint Report.—The annual report of the Deputy-Master, Sir Thomas Elliott, shows that during 1912 171 million coins, the highest figure on record, were produced. Of this total 162½ million were for Imperial issues, and 8½ million for Colonial use. Of the Imperial coinages, which exceeded by nearly 34 million any previous total, 36½ million pieces were gold, 49 million silver, and 77 million bronze.

The figure for bronze coins is nearly double the average of recent years, and the unprecedented demand was undoubtedly due to the increased use of small change rendered necessary in the payment of wages by the operation of the National Insurance Act. The net profit on the year's operations was £1,243,576. In the memorandum by Mr. Rigg, superintendent of the Operative Department, it is stated that the efficiency of the new gas furnaces (see ELEC. REVIEW, November 1st, 1912, p. 704) has been further improved. For the nine months in 1911, in which they were in use, the cost per cwt. of bullion melted was 13·8d., whilst in 1912 the cost per cwt. melted was 10·3d.

During the year the new buildings required for the various processes involved in the preparation of dies and plates for printing stamps were taken over from the Office of Works. In the moulding and depositing room six depositing baths for copper, four for nickel and one for steel facing, with the requisite washing tanks, were erected. Four motor-generator sets were also installed in a special glazed enclosure, the switchboard for the same being placed in the depositing room for greater convenience. In connection with the preparation of postage stamp plates and dies for postcards and wrappers, 111 copper electros, 1,098 nickel electros and 218 steel-faced electros were grown. For National Health and Unemployed stamp plate requirements, a total of 131 plates were grown, which, with two exceptions, were of nickel.

A motor-driven pump for the new exhaust steam heating plant has been erected in the cyanide hardening shop, as well as a motor-driven blower for work in connection with the die and seal branch.

The completion of the new buildings referred to above, and of the new gold melting house, has led to an extension of the electric light and power equipment. The number of motors in use has increased from 89 to 99, and their gross H.P. from 786 to 834¾. The arc, flame and silica lamps number 71, as against 78 in 1911.

Incandescent lamps in official premises have increased from 798 to 995, whilst the number in private residences remains the same—210.

The average monthly output of the Mint generators during 1912 was 30,058 units, as compared with 29,163 for the previous year.

In connection with the Ottawa branch of the Royal Mint, the Deputy-Master (Dr. Jas. Bonar) states that the introduction of separate dynamos for the gold and silver cells (see ELEC. REV., November 1st, 1912, page 704), in use in the new electrolytic refining plant, has proved satisfactory. Ten silver and 12 gold cells were in use throughout the year, and provision is already made for six additional cells, in order that the necessary periodical cleaning may proceed by six cells at a time, and leave 12 always at work. The automatic heating has been reduced to eight hours, and may possibly be dropped altogether.

Institution and Lecture Notes.—Manchester Association of Engineers.—On October 11th the inaugural address was delivered by the President, Dr. Edward Hopkinson, who reviewed the development of electrical engineering and its influence on mechanical engineering. He remarked that in the hands of the pioneer of the new branch of engineering there was necessarily closer touch with, and more intimate dependence upon, physical principles and theoretical scientific knowledge than in the older branches. So it was that electrical engineers were quick to realise that the efficiency of the dynamo and motor could and must be determined with accuracy, with the result that in the course of five or six years the efficiency was brought from a general level of probably about 75 per cent. up to 93 to 94 per cent., beyond which even the succeeding quarter of a century had carried us but little higher. This bedrock understanding of the efficiency of the dynamo had had a profound effect on all branches of engineering and mechanics, and had extended even beyond into regions of social and political activity. Very soon it became essential accurately to determine the efficiency of all machines converting energy from one form to another, with the result that, knowing what the loss in conversion was, and where it occurred, invention followed investigation and great improvements resulted. Electrical science differed fundamentally from others, in that the electrical engineer having no material conception of the electrical quantities he was dealing with, and being dependent entirely on being able to express them and measure them in terms of the fundamental units of mass, length and time, must necessarily treat his subject from a more purely mathematical point of view. No electrical engineer could acquire a competent knowledge of his subject without a knowledge of mathematics. No factor in the development of a branch of engineering had greater influence than the power of accurate measurement, and it had been foremost in contributing to the advance of electrical engineering. Nothing contributed more to accurate thought and reasoning, and accurate expression of thought in the student, than the opportunity and habit of making physical measurements with a high and known degree of accuracy. If he were restricted to one word of advice to engineering students, and indeed to all who followed the profession of engineering, he would say strive and study above all things to be accurate in measurement, precise in thought and knowledge, and exact in expression. Such qualities, though based on the moral desire to be truthful and honest in word and deed, involved much more, and could only be acquired by careful early training and constant striving after an ideal, which must be set up in youth. Their realisation would bring with them abundant personal reward, and was the only foundation upon which the future development of the profession in which they were all interested could be securely built.

Institution of Municipal Engineers.—The fifth annual general meeting will be held in London on Friday, November 7th. The Presidential address will be delivered at 2.45 o'clock, several papers will follow, including one by Mr. R. J. Spencer-Phillips, on "Electricity as a By-Product." A special general meeting is called for earlier on the same day, for the consideration of the proposed by-law amendments.

The Concrete Institute.—The thirty-ninth ordinary general meeting will be held at Denison House, on Thursday, November 13th, at 7.30 p.m., Mr. E. P. Wells, J.P., will deliver his Presidental address.

Birmingham and District Electric Club.—The opening meeting of the Club was held on Saturday last, at the Birmingham Electric Supply Department's showroom, 14, Dale End. Mr. W. E. Milns, of the Birmingham Corporation, gave a lecture on "Electric Cooking," with various demonstrations. It being a ladies' night, a large number of interested ladies attended and expressed themselves delighted with the apparatus shown, and much appreciated the examples of electric cookery which were handed round. The lecturer commenced by dealing with the ideal oven, and succeeded in showing that the electric oven was the nearest approach to this ideal. Various types of ovens were compared, and hints given on the selection of electric ovens. The important question of costs was dealt with, actual figures being put forward to show that on the score of expense electric cooking compared favourably with any other form. A year's cooking for a family, including the electric heating of two rooms, electric kettles, irons, &c., actually worked out at no more than £10. Advice as to the economical use of ovens was given, and it was shown that on an intelligently-selected *menu* one or two courses could be cooked after current was actually switched off.

At a recent meeting of the Institute of Mining, Mechanical and Metallurgical Engineers for Cornwall and Devon, at Camborne, Mr. L. A. Hards, manager of the Cornwall Electric Power Co., read a paper on "The Application of Electricity to Cornish Mining." He said that there was nothing above ground or below which could not be successfully dealt with electrically, excepting large winders.

Association of Mining Electrical Engineers (East of Scotland Branch).—The opening meeting of the session of this branch was held on Friday last at Dunfermline. The new Branch President (Mr. H. Gordon Fraser, Leven) delivered an interesting address, in which he regretted the fact that colliery electricians only represented 7 per cent. of their total membership. They must have in their ranks the men who actually installed and operated the electrical plant at the collieries. A paper by Mr. Peat, on "The Electrical Plant at Dalbeath Colliery," was discussed at some length.

(West of Scotland Branch).—The opening meeting was held on Saturday evening in the Royal Technical College, Glasgow. Mr. Matthew Brown, general manager of the Banknock Coal Co., the branch president, was in the chair. In the course of his Presidential address the chairman alluded to the gratifying fact that the branch was now the strongest, numerically, in the Association, and that its strength and influence had been recognised by the other branches in that, Mr. Alexander Anderson, one of their members, had been unanimously elected president of the general body. It was encouraging to note, further, that Mr. Wm. Walker, Chief Inspector of Mines for the Scotland Division, in his most recently published report, believed that the Scottish branches of the Association had to some extent been responsible for securing at the majority of mines throughout the country a better class of colliery electricians. Mr. Brown concluded his Presidential address by presenting Mr. James McCann, colliery electrician, Carron Collieries, with a prize of four guineas for the practical paper read by him in the course of last session on "Coal Cutters."

It was announced that the Council had arranged to hold a series of district meetings at Larbert, Hamilton, and Kilmarnock, with a view to stimulating greater interest in the work of the Association. The branch secretary (Mr. Davis Martin) intimates that papers on the undernoted subjects have been arranged for:—"Wireless Experiments," by Mr. James R. Laird; "Electric Winding," Mr. James Gillespie; "Specifying and Buying Electrical Mining Plant," Mr. J. P. C. Kivlen; and "Rock Drills," by Mr. C. E. Hart.

Last week a lecture was given by Mr. W. A. Toppin, President of Greenock Electrical Society, on "Motor-Driven Machinery." The lecture was illustrated with lantern slides, for which the author acknowledged his indebtedness to Messrs. Laurence, Scott and Co., Ltd., the Lancashire Dynamo and Motor Co., Ltd., Vickers, Ltd., and Royce, Ltd.

Rifle Club Match.—On Tuesday evening last, the 21st inst., a return match between Siemens Dalston Miniature Rifle Club and the Western Electric Co. was shot at Dalston, the result being a win for Siemens. The average scores were 95·3 for Siemens, and 88 for the visitors.

German Enterprise Overseas.—In a study of the expansion of German enterprise abroad, the *Revue Pratique de l'Electricité* states that in Russia the Germans have easily triumphed over the American competition; with the exception of the tramways, which the Belgians have kept, they preponderate in the production and distribution of electric power in St. Petersburg, Moscow, Warsaw, Lodz, Kiev, Baku, and Kabarowsk. The oldest concern is the Electric Lighting Co. of St. Petersburg, established in 1886, with a capital of 1,000,000 roubles. It secured the concession for St. Petersburg in 1898, and that for Moscow in 1895. It has taken over since, in 1909, the concession secured in 1900 by Siemens & Halske for Lodz. In 1912 the capacity of its machinery and plant totalled 120,000 H.P., with 729 km. of cable at St. Petersburg, 1,007 km. at Moscow, and 180 km. at Lodz. The principal German concerns are:—

	Capital. Roubles.	Net profits. Roubles.
Electric Lighting Co. of St. Petersburg	40,000,000	3,981,376
Electric Power Co., of Baku	4,025,000	327,346
Kiev Co.	6,000,000	746,000
Warsaw Co.	3,562,410	460,187

The German Transatlantic Electric Co. was constituted about 15 years ago, with the object of working electric installations and accessory operations, but excluding electric constructions. Its sphere of action is restricted to America. At the present moment the company has four principal seats (Buenos Ayres, Santiago, Valparaiso and Monte Video). At Buenos Ayres it holds, without monopoly, a concession for the production and distribution of light and power until 1957; at that date the city will become the owner of the installation; until then it will draw 6 per cent. of the gross receipts. The number of KW.-hours sold has advanced from 9,300,000 in 1901 to 129,000,000 in 1910. On December 31st, 1911, the aggregate capacity of these stations totalled 74,760 KW.; the length of the cables is 3,068 km., laid in underground conduits.

In the other cities of South America, the company only works indirectly. It is interested in the Chilian Electric Tramway and Light Co., which owns 120 km. of tramways, carries nearly 100,000,000 passengers, and possesses stations which supplied in 1911 200,000,000 KW.-hours. The Deutsche Ueberseeische Elektricitäts Gesellschaft A.G. holds the whole of the 6 per cent. preference shares and more than half of the ordinary shares. It is the holder of all the capital of the Valparaiso tramways (43 km.), and owns a considerable part of that of the tramway company of Monte Video. It has, besides, made considerable advances to two later enterprises. The more lucrative is that of Buenos Ayres, which made £1,015,000 gross profit in 1911. The share capital of the Deutsche Ueberseeische Elektricitäts Gesellschaft A.G. has been raised by successive issues from £500,000 in 1901 to £6,000,000 in 1912. The five latest issues were made at premiums rising from 115 to 130 per cent. At the same time, the company has contracted, between 1903 and 1911, a bond debt of £4,250,000 at 5 per cent. interest, the first issues being repayable at par, the others at 103. According to the balance-sheet of December 31st, 1911, the stations stood for £8,200,000, participations for £1,500,000, and advances for £2,350,000. The capital was £5,000,000, the reserves £1,400,000, and the bonds £4,220,000.

Appointments Vacant.—Assistant installation inspector, for Stepney Borough Council (30s.); laboratory demonstrator and lecture assistant, for Northampton Polytechnic Institute (£110); charge engineer for power station in India; switchboard attendant, for Erith Corporation (20-25s.); two junior assistant engineers for power station and sub-station, for Bury Corporation (32s. 6d. to 37s. 6d.). Particulars are given in our advertisement pages.

Educational Notes.—Concrete Institute.—A course of six lectures on "Reinforced Concrete, its Commercial Development and Practical Application," will be given by Mr. H. Kempton Dyson, secretary of the Concrete Institute, at 5.30 p.m. on Wednesdays, November 12th to December 17th, 1913, in the Lecture Hall of the Institute. There is no fee for the course; admission will be by ticket obtainable on application from the Secretary, The Concrete Institute.

Mr. H F. Osler, chairman of Messrs. F. & C. Osler, Ltd., electrical fittings makers, who died on August 10th, left estate valued at £69,029 gross, with net personalty £64,291, a large portion of which will eventually revert to Birmingham University.

Imperial College of Science and Technology.—Scholarships have been awarded by the Delegacy, in the Department of Electrical Engineering, to R. F. H. Nalder (son of Mr. F. H. Nalder), R. H. Barfield and G. S. Oddie.

Northampton Polytechnic Institute.—Six special lectures on "Business Engineering in its Legal Aspects" are to be delivered by Major W. A. J. O'Meara, C.M.G., &c., on Tuesday evenings, commencing on November 4th. Particulars appear in our advertisement pages to-day.

Copper.—Messrs. Merton's circular for the half month shows the price even lower than for the termination of September. English stocks have fallen during the fortnight 955 tons, to 14,179 tons, while French are better by 391 tons. Total European supplies (including Rotterdam, Hamburg and Bremen, and estimates from other European ports) amount to 28,177 tons, a reduction of 742 tons for the fortnight.

Arrivals during the fortnight from North America are low, Spain and Portugal ditto, Chile shipments rather short, but Australian above average. Deliveries, at 17,184 tons, do not promise a large demand for the month. The high price and recent buying appear to be keeping the consumer off for the present. American stocks, as published by the American Producers' Association, have reached a low figure—13,300 tons at the end of September. The difference from the end of August is 3,804 tons, or about one-quarter of the present quantity. The total world's supply at the same date, including Holland and Germany, was 41,119 tons.

British Radium.—It is reported that the British Radium Corporation, Ltd., whose shares have just been placed upon the market, has secured the exclusive rights for mining pitchblende (uranium and radium) at the Trenwith Mine, St. Ives, Cornwall, under lease for 42 years from July 15th, 1908. Since 1911 the company has extracted and sold radium and uranium products approximately to the value of £33,000. Forward contracts have been made by the directors to the value of £35,000. It is calculated that the supply of ore already to hand is sufficient to occupy the works for several years. By means of automatic working in the manufacturing operations, it is hoped to reduce the cost of production to a minimum.

Fatalities.—On Monday an inquest was held at Wallsend and Newcastle on the bodies of W. Amos and R. Walton, who both died as the result of injuries sustained in the Newcastle tramcar smash. Evidence of identification was taken, and the inquest adjourned pending the appearance of Linkhorn, the driver of the repair car.

The Madrid correspondent of the *Daily Telegraph* reports that at Cartagena an electric cable carrying 1,000 volts got loose and fell down in a chemical factory on a wagon conveying nine workmen. Six of the men were killed instantaneously, and the three others were badly injured. A judicial investigation has been ordered.

Osram Week.—Owing to the success of their previous similar efforts, the General Electric Co., Ltd., have organised another "Osram Week" Campaign," commencing on Monday next, October 27th. This year the condition of former years, that an order be placed for a specified number of lamps, is not imposed, all the assurance required from electrical firms desirous of co-operating in the scheme being that they will stock Osrams. The details of Osram week are doubtless familiar to most of our trade readers, but we may say that very full information relating to the very extensive scheme of prominent advertising in daily newspapers and other publications next week, bringing the word Osram and the names of local contractors under every reader's eye, can be found in a bulky portfolio containing copies of the special advertisements that are to appear and of all kinds of publicity posters and literature that will be distributed. Firms or others wishing to co-operate in this matter should at once write to the Publication Department of the General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.

Birmingham Electrical Golfing Society.—A society under the above title has been formed in Birmingham, and is open to all golfers in the electrical trade in the Midlands. The annual subscription is a nominal one, and includes free admission to three meetings per year, viz.:—Spring, Summer and Autumn. Substantial prizes are put up for competition. Application for membership should be made to the hon. secretary, Mr. W. A. Millinger, 9, Livery Street, Birmingham. The autumn meeting has just been held, and a cup presented by the Metallic Seamless Tube Co. was tied for by Messrs. J. D. Masters and F. Boyes, Mr. J. D. Masters being the winner in the play-off.

Colonial Demand for Engineers.—At a meeting of the Cheshire Education Authority at Crewe on 12th inst., it was decided to offer a series of University Scholarships. The chairman (Dr. Hodgson) said that they had been in communication with the authorities at McGill University, Montreal, and had arranged that Chester County and Technological Scholarships might be held for the whole or part of the three years for which they are awarded in the case of engineering students at McGill University. At that University they found there were 60 students coming out in the year, and over 400 applications from large employers of labour for these students who were leaving with the degree in engineering. There were immense openings in the Colonies for engineers with University training. He thought it would be a good thing for scholarship holders to spend two years at a British University and go to McGill University for the completion of their three years.—*Morning Post.*

Patent Litigation in America.—In view of the many electric engine-starting devices for use on motor-cars which have recently been brought out in the United States, it is perhaps not surprising to learn that patent litigation is being commenced. The Dayton Engineering Laboratories Co., of Dayton, O., the makers of the Delco starter, are the first in the field, they having just commenced an action against the North-East Electric Co., of Rochester, N.Y., for infringement of their patent.

Russian Railway Lighting Proposals.—H.M. Embassy at St. Petersburg reports that the Railway Department of the Russian Ministry for Ways of Communication is at present engaged on a scheme for the substitution of electric light for the lighting systems now used on the Russian State Railways. Foreign firms will be allowed to compete for this work, and United Kingdom firms desirous of putting in tenders should in the first instance formally notify the Minister for Ways of Communication of their desire, by means of a petition in the Russian language; it should be in duplicate and should specify previous contracts of a similar character which have been executed by the petitioners. The firm will then receive details of the requirements of the Russian Government.

Electro-Harmonic Societies.—There was a very large attendance at the first concert for the season of the Electro-Harmonic Society on Friday last; Mr. Frank Gill occupied the chair, and the entertainment was, as usual, thoroughly enjoyed. The next concert (ladies' night) will take place on November 17th.

The Manchester Electro-Harmonic society had a record attendance at its concert on the same evening, and several new members were enrolled. During the course of the evening a telegram of mutual congratulations was sent to the Electro-Harmonic Society, whose concert was in progress at the Holborn Restaurant in London. We are asked to assure members of the latter society that they will always be heartily welcomed at any of the Manchester Society's concerts.

Electricity for Lead Poisoning.—At the provincial meeting of the Royal Sanitary Institute at Newcastle on Saturday last, Mr. T. M. Clague, Ph.C., gave a demonstration of a new process of electrolytic treatment of lead poisoning, discovered by himself. It was found that by passing an electric current through the human body the lead could be extracted. Several manufacturers had put in installations, and as soon as an employé showed any signs of the poisoning he was treated. Very good medical results had been obtained, and considerable quantities of lead extracted from the men treated.

Company Secretary Fined.—According to a report in the *Times*, the secretary of the Patents Exploitation Trust, Ltd., was fined £4 and £1 costs at the Guildhall, for not calling a general meeting of the company once at least within a calendar year and not more than 15 months after the last annual meeting.

Lignite as Station Fuel.—It is announced that the Berlin Electricity Works Co. has now completed the purchase of the lignite mine of Golfra-Jessenitz, on which an option was secured several months ago. At the same time, the company in conjunction with a friendly syndicate has also obtained possession of a neighbouring mine—the Sachsenburg at Zschornewitz, near Bitterfeld. These mines are expected to render it possible to reduce the cost of production, and in the event of the renewal of the company's agreement with the Berlin municipal council the reduction in prime costs will enable Berlin consumers to be supplied at cheaper rates. The right of expropriation of the company's undertaking within the next two or three years is vested in the municipal council, although it is uncertain at present whether the right will or will not be exercised. Preliminary discussions on the matter have been proceeding between the company and the authorities for some time past, the former attaching considerable importance to the agreement being prolonged for a lengthy period. In the event, however, of the undertaking being transferred to the municipality in the course of the next few years, the company expects to utilise the lignite mines in connection with the generation of energy for supply to railways, large private consumers and existing electric supply works. The company already owns or controls, in association with a large manufacturing firm, several supply works outside Berlin, these having been acquired so as to ensure the continuation of activity in the supply department, even if the Berlin business should pass out of its possession.

The A.E.(S.)E.—The Assembly Room at the Crow's Nest Hotel, Newcastle-on-Tyne, was comfortably filled on Friday last on the occasion of the Association of Electrical (Station) Engineers' first smoking concert. The remarks made by the chairman (Mr. J. W. Lanham) and the local secretary (Mr. J. M. Fishley) in support of the Association were received with loud applause. A splendid programme was arranged and rendered from talent amongst the engineers. Owing to the success of the concert, the Committee is arranging for another in the near future.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. S. H. FOWLES, for two years mains assistant to Dewsbury Corporation, has obtained the post of mains superintendent of the southern district of the county borough of Stoke-on-Trent. MR. W. W. FIRTH, at present junior mains assistant to Dewsbury Corporation, has been appointed as successor to Mr. Fowles.

The Colne Electricity Sub-Committee has appointed MR. F. W. JENKINS, charge engineer of the Scottish Central Power Co., Bonnybridge, to the post of senior shift engineer.

General.—The staff of Messrs. Christy & Co., Ltd., of the Arc Works, Chelmsford, have presented a canteen of cutlery to MR. JULIAN A. R. PITTS, head of the order department, on the occasion of his marriage.

MR. F. CHARLES RAPHAEL, editor of *Electrical Engineering*, asks us to state that he is not the Mr. Raphael who supported the directors' policy at the meeting of Metalite, Ltd., reported in our last issue, nor is he in any way connected with that company; furthermore, neither he nor any of his relatives are in any way interested in any concern manufacturing electric lamps.

MR. W. H. MULHALL, who was formerly associated with Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston Works, as traction lamp expert, has been transferred to the Glasgow branch to handle their general electrical business in that district.

At the annual dinner of the National Association of Local Government Officers in London last Friday, MR. H. E. BLAIN, vice-president, was presented with a gold watch and chain and a silver tray in recognition of the part played by him in forming the Association.

MR. W. G. PAGE has joined the staff of the Safetee Controlling Appliances Co., Ltd., and is now travelling on their behalf.

MR. L. WEEKES, general manager of the British Electric Calibrated Fuse Co., has lately left England on the ss. *Virginian* for Montreal, from whence he will proceed right across country, calling at all the large towns *en route*.

The Manchester Education Committee on Monday approved the appointment of MR. ALLAN B. FIELD, M.I.E.E., chief designer of turbo-electric machinery to the Westinghouse Electric Co., Pittsburg, to the position of Professor of Mechanical Engineering at the Manchester School of Technology, in succession to the late Prof. J. T. Nicholson.

We regret to learn that Mrs. E. J. Smith, wife of MR. THOMAS ROBERT SMITH, engineer of the tramways and electricity department of the Leicester Corporation, passed away on Sunday in her forty-fourth year, after several months' illness.

The marriage took place at Lansdowne Baptist Church, Bournemouth, on October 15th, of MR. GEORGE A. PARRY, of Westbourne, son of Mr. Geo. Parry, of Croydon, and Miss M. Kitcher, daughter of Mr. Henry C. Kitcher, of Messrs. H. C. Kitcher & Sons, electricians, of Bournemouth.

MR. ARTHUR C. HEAP, of the firm of Heap & Digby, left London, on 18th inst., for the United States and Canada.

MR. ERNEST LAUBACH has resigned the position of manager of the Harland Engineering Co.'s Manchester office, in order to join Messrs. Siemens & Halske, in Berlin.

A marriage took place on Saturday, October 11th, between MR. H. GRANT, head of the accounts department of Messrs. Veritys, Ltd., London, and Miss Redwood, secretary to the managing director. The directors and staff presented Mr. and Mrs. Grant with a very handsome case of cutlery.

Obituary.—MR. A. W. KRAUSS, contractor, of Bristol, was killed in an accident to his motor-car, at Rio de Janeiro, last week. He was 40 years of age.

MR. ARTHUR CHAMBERLAIN.—We regret to record the death, which occurred on Sunday, at the age of 71 years, of Mr. Arthur Chamberlain, who was interested in Kynoch's, Ltd., Tubes, Ltd., Chamberlain & Hookham, and many other industrial concerns.

NEW COMPANIES REGISTERED.

Lighthouse Radiator Co., Ltd. (131,590).—This company was registered on October 14th, with a capital of £500 in £5 shares, to carry on the business of manufacturers of, and dealers in, apparatus and appliances used in connection with electricity, gas, petroleum or other power or spirit for the purpose of water heating or cooking, &c., and to adopt an agreement with E. A. Welch. The subscribers (with one share each) are:—W. Slater, Albion Hotel, Woking, hotel proprietor; S. H. Harper, Albion Hotel, Woking, hotel manager. Private company. The number of directors is not to be less than two or more than three; the first are W. Slater, F. C. Hunt and E. A. Welch; qualification, £20; remuneration (after first year) as fixed by the company. Registered by H. Hunt, 3, High Street, Woking.

Midland Fan Co., Ltd. (131,572).—This company was registered on October 13th, with a capital of £2,000 in £1 shares, to take over the business of a ventilating engineer carried on by H. Humphreys at 55, County Chambers, Birmingham, as the Midland Fan Co., and to carry on the business of engineers, designers, manufacturers and erectors of fans, blowers, exhausters and other ventilating appliances, &c. The subscribers (with one share each) are:—H. Humphreys, 55, County Chambers, Corporation Street, Birmingham, ventilating engineer; R. Parr, Drakeness Cottage, Hollywood, near Birmingham, agent. Private company. The number of directors is not to be less than two or more than four; the first are H. Humphreys and R. Parr (both permanent); qualification, £500; remuneration of H. Humphreys as manager, 20 per cent. of the net profits. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

Whitstable Electric Co., Ltd. (131,603).—This company was registered on October 14th, with a capital of £18,000 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers of and dealers in electricity, motive power and light, &c. The subscribers are:—E. A. Chell, 68, Ferndene Road, Herne Hill, S.E., managing director, Rodney Foundry Co., Ltd., 100 shares; A. R. Day, 43, Cromwell Road, Whitstable, managing director, Oxford Picture Hall Co., Ltd., 100 shares; G. W. Bisson, 76, Oxford Street, Whitstable, dairyman, 100 shares; F. Tyars, Gumshill, Whitstable, actor, 100 shares; Sir John H. Dimsdale, Bt., "Goldsmiths," Whitstable, 100 shares; O. C. Wylson, "Beacondene," Tankerton, architect, 100 shares; J. W. Thwaites, Otago, Whitstable, salesman, 200 shares. Minimum cash subscription, £3,500. The number of directors is not to be less than three or more than seven; the first are E. A. Chell, A. R. Day, G. W. Bisson, F. Tyars, Sir John H. Dimsdale, Bt. and O. C. Wylson; qualification, £100; remuneration, £375 per annum and a percentage of the profits divided between them. Solicitor: G. Stainton, Whitstable. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Central Wireless Co, Ltd. (131,661).—This company was registered on October 17th, with a capital of £1,000 in £1 shares, to establish and carry on in Birmingham or elsewhere schools for providing instruction in the science and practice of wireless radio-telegraphy, to deal in apparatus and instruments required in connection therewith. The subscribers (with one share each) are:—T. A. Graves, 10, Haven Green, Ealing, secretary; A. Drew, 1A, Ewhurst Road, Crofton Park, S.E., clerk. Private company. The first directors are Major C. P. Scudamore, L. J. Graham and J. McKeevor. Registered office, 45, Newhall Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £100 on July 18th, 1913, of charge dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed. (Notice filed October 13th.)

Newcastle-upon-Tyne Electric Supply Co., Ltd.—A memorandum of satisfaction in full on October 8th, 1913, of debs. dated October 24th, 1912, securing £250,000, has been filed.

Wellingborough Electric Supply Co, Ltd.—Particulars of debs. for an amount not exceeding one-half of the issued capital for the time being, created July 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,300. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Sunderland District Electric Tramways, Ltd.

MR. H. R. HOGG (chairman) presided on October 16th at Winchester House, E.C., over an extraordinary meeting of the preference and ordinary shareholders of the above company. At the preference shareholders' meeting the Chairman formally moved a resolution reducing the capital of the company, and it was carried without dissent. A similar resolution was carried at a meeting of the ordinary shareholders, and then at a combined meeting of the preference and ordinary shareholders the Chairman moved, and Mr. Taylor seconded, the following resolution:—

(1) That this meeting of ordinary shareholders hereby approves the proposed reduction of the capital of the company from £170,485 to £51,497 by the cancellation of the sum of 10s. per share upon each of the 95,495 preference shares of £1 each, and the sum of 19s. per share upon each of the 74,490 ordinary shares of £1 each. (2) That the rights of preference shareholders may be varied or modified in the following manner:—(*a*) That all arrears of dividend in respect of the preference shares be extinguished and cancelled. (*b*) That as and from the date of this resolution the preference shares be changed from cumulative shares to non-cumulative shares, entitled to a non-cumulative preferential dividend of 12 per cent. per annum.

The resolution was agreed to without any discussion.

Drake & Gorham, Ltd.

THE annual meeting was held at the offices in Westminster on October 16th.

MR. B. M. DRAKE, who presided, after moving the adoption of the report (see ELECTRICAL REVIEW, page 587), said that the year's profit of £10,268 compared with £9,021 and £7,184 for the two preceding years, so that there had been a steady improvement. As they were writing off the balance of the underwriting commission, viz., £4,000, this item in future would disappear from the balance sheet. It was proposed to pay a dividend of 5 per cent., as against 4½ per cent. for last year. During the year they had had their share of the better class of work, though some people seemed to think that electrical work, which requires a technical education and was full of pitfalls to the uninitiated, could be safely entrusted to plumbers and men of other trades. Unfortunately for the industry, no diploma or examination was at present necessary to qualify for electrical work, and the best protection for the public was to deal with old-established firms who had a reputation to maintain. Probably there was no branch of engineering in which a slightly higher price to cover the best work in the first instance proved a sounder investment in the long run. Electricity was a useful servant, but, like other servants, it required careful handling. Their Manchester office had done exceptionally well this year, and was busy with lighting and power work. Their Manchester managing director, Mr. George Hamilton, was elected M.P. for Altrincham, but he had agreed to remain on the board, and arrangements had been concluded by which he would continue to supervise the Manchester office. The chairman then gave a lengthy list of the year's *clientèle*, including H.R.H. the Prince of Wales (Tor Royal), the Duke of Westminster, the Earl

of Ellesmere, and many other distinguished people. Metal lamps had been still further improved during the year, and lamps of large canlde-power were now ready for the market which used only half the energy of those commonly employed at present. In their wholesale business there was again a considerable increase. This section was conducted as a separate organisation, the controlling offices being situated at Felix Street, Westminster Bridge Road, adjoining the company's works. The ratio of profit made during the past two years had been maintained, and a slight reduction effected in the working expenses. The progress of the Liverpool business, which they purchased for the wholesale department, had more than answered their expectations. The turnover had largely increased, also the rate of profit. The consideration for goodwill to be satisfied from profits had nearly been met already, so that it was hoped that this branch would contribute to the next balance-sheet. A new catalogue embracing everything electrical was in course of preparation, and would shortly be issued to trade users. During the year the works, besides supplying their own requirements, had manufactured main switchboards for the Admiralty buildings, Home Office, Colonial Office, Marlborough House, and the British Museum, and had others in hand for Windsor Castle and the Natural History Museum. A number of the patent petrol gas machines had also been made. In conjunction with Colonel Holden a semi-automatic electric generating plant had been designed and was under test. It consisted of a self-contained set which after starting would run without attention till the battery was charged, when it automatically stopped. He considered this preferable to the all-automatic sets, for every plant required cleaning, refilling with fuel, and attention to the oil cups and brushes, and it entailed but little more trouble for the attendant to start the engine, after which he could leave it to itself. Also the restarting and stopping of the engine, while lights were in use, was apt to cause fluctuations and use current unnecessarily. Their arrangement had the merit of being less complicated and cheaper in first cost, and it could, in many cases, be added to existing plants. Long experience had shown that the only consistently reliable method of obtaining a steady light in country houses was the provision of an ample storage battery which was charged during the day. Although engines with a small battery and complicated apparatus might work well at first, there was always a day of reckoning, and this usually at an inconvenient time. When in America this year he was much impressed by the large number of commercial and pleasure vehicles propelled by electricity in the different cities visited, and as the information obtained showed that the cost per ton-mile was considerably less than for horse traction or petrol, this company had made arrangements to supply electric cars forthwith, which he hoped might soon develop into a large business.

The motion was seconded by Mr G. C. Hamilton, M.P., who briefly referred to the improvement that was taking place in country house installation business this year, and mentioned that he thought that there was a very good opening for electric vehicles here. He hoped that that branch of their business would soon develop into a remunerative one.

The report was adopted.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held at Newcastle-on-Tyne on 20th inst., Mr. James Falconer, M.P., chairman, presiding.

The Chairman said, in moving the adoption of the report (see Electrical Review, page 627), that the report of the year's working showed substantial progress, both in the development of the volume of business and also in the profits earned. He submitted statistics of the company's revenue from the year 1909 to 1913. These showed that in 1909 the revenue was £83,850; 1910, £105,576; 1911, £126,452; 1912, £120,145; 1913, £132.427. The costs for these years were: In 1909, £73,557; 1910, £86 632; 1911, £99,516; 1912, £85,449; 1913, £88,837. So that while the revenue had increased by £50 000, the costs had only gone up by about £15,000. In the same period the profits had increased from £10,293 to £43,590. At the present time they had contracts arranged which provided for additional horse-power, and this compared very favourably with their position at any previous meeting. One feature of these contracts was very gratifying, and that was that they had an important contract with the North-Eastern Railway Co. in connection with the electrification of a portion of their system, which was equal to about 20 miles of single line, and which was intended as a test of working the kind of traffic that the railway company had between Shildon and Newport. It was no secret that this might lead to further extensions of electrification and held out good prospects of business for the company in the future. Their finances as regards the debentures were now placed upon a sound and permanent footing. The position when they met last year was this: They had first debentures of £115,000, and they had second debentures of £225,000, all of them terminable at the end of last year. That had been so arranged to enable the company, after its business had developed, to make a more permanent arrangement on satisfactory terms. Well, after much negotiation, they had succeeded in making an arrangement with the second debenture-holders, under which the second debentures, amounting to £225,000, would be renewed over a period terminating in 1942. They had also arranged for an issue of first mortgage debentures, the total amount of which was £250,000, which were repayable over periods which terminated in 1935. Now, with regard to this £250,000, it was to be applied to the extent of £135,000 in paying off the existing first mortgage debentures of £115,000, and to the extent of £72,700 it was to be applied to the purpose of acquiring debentures up to the amount of £70,853 of the Parliamentary company with a view to consolidating these with the debentures of the limited company, and the balances, which would amount to £47,000, would be available for the purposes of the company in the future. They had asked for subscriptions for the £135,000, and he was glad to say they had been able to have the whole of that sum taken up. The net result of those operations was that they had arranged for the first and second debentures over a period which made their company financially secure and stable. The provision made for the repayment was that in 1919 a sinking fund of £10,000 per annum would be provided for the redemption of the debentures. The prospects of the company were such that before that time they would, he thought, be in a position to pay that £10,000 and fulfil all their obligations, and leave a very substantial margin for payment by way of dividend to their shareholders. They wished to change their financial year from ending on June 30th to ending on December 31st, so as to be in accord with the Parliamentary and the Northern Counties Co., and also so as to facilitate the task of drawing up the accounts. He thought this would be in the shareholders' interests, and what they proposed to do was to deal with the next six months, from June 30th, 1913, to December 31st, 1913, separately. They had had two special Acts of Parliament passed, one for the Parliamentary company and one for the Northern Counties company, with a view to giving them complete security for plant which belonged to them, and which might be erected on the premises of consumers.

Mr. Philip E. Noble seconded the adoption of the report.

Mr. Young, a shareholder, asked if the chairman could give any reason for the unsatisfactory position in which the company had been placed. He was told it was due in a great measure to the one-sided agreement which the directors had entered into, without the consent of the shareholders, with the Waste Heat Co., and he would like to know whether that was so.

Mr. Parsons also asked a question in regard to the Waste Heat Co. The report spoke of another project in waste heat being undertaken. Did that mean that the Power Co. were going to work it directly, or did it mean that it was going to be worked through the Waste Heat Co.? If the latter, why should they not work it directly?

The Chairman said the current they purchased from the Waste Heat Co. was, he believed, the cheapest supply of current which was to be found anywhere. They got from the Waste Heat Co. a supply of current on terms more favourable than they could get it elsewhere or generate it themselves. The advantageous character of this contract was shown by the fact that they supplied energy to the Durham and Newcastle Electric Companies—energy which they received through their contract and re-sold at a profit. No doubt the Waste Heat Co. had done well out of the arrangement, but then it was a great venture and a great enterprise to establish it. On the other hand, he had no doubt that they (the Power Co.) had done infinitely better than if they had had to supply energy themselves.

Mr. Gemmell said, in his opinion, the waste heat arrangement had been most ruinous to the ordinary shareholder. He also asked whether the board would take steps to ensure their auditors being the auditors of the three companies.

The Chairman having replied, the report was adopted, and a dividend on the preference shares at the rate of 4 per cent. was declared.

Marconi Wireless Telegraph Co. of Canada.

The report of the company for the year ended December 31st last, published in the *Financial Times*, states that under the new contract with the Canadian Government for the operation of wireless telegraph stations on the Great Lakes, four stations have been erected and placed in operation during the past year. One station is now being enlarged, and three other stations are to be built during the current year. The negotiations with the Newfoundland Government were brought to a satisfactory termination in December by completing a contract, which will continue the company's exclusive rights in Newfoundland until the year 1926. The number of steamers now operated by the company on its own behalf is 44, and, in addition, four steamers are operated on behalf of affiliated companies. As the old contracts for the equipment of steamships expire they are being replaced wherever possible by new standard contracts, by means of which better conditions are secured to the company. The standard ship contract is for a period of five years. The trans-Atlantic station at Glace Bay has been operated by the company on its own behalf throughout the year, and towards the end of the year the construction of the duplex receiving station at Louisburg and the construction of the six-wire pole line connecting that station with the transmitting station at Glace Bay were completed. The duplex system will be put into operation as soon as the corresponding station, now in course of construction at Clifden, Ireland, has been completed. A large sum of money has been invested in these undertakings, but it is confidently anticipated that the increased returns will not only fully warrant the expenditure, but will also assist in bringing much better returns on the total outlay at the Glace Bay station. The traffic receipts for the year have shown a satisfactory increase in all departments. The ship-to-shore station receipts totalled $52,300, as against $45,400 in 1911-12. The trans-Atlantic returns totalled $45,000, as against $27,700 in the previous year. During the recent session of Parliament the Canadian Government enacted a law making the wireless equipment of passenger vessels plying in Canadian waters compulsory.

Cape Electric Tramways, Ltd.

The directors' report for the year ending June 30th, 1913, states that the profit and loss account shows a profit of £80,978, and after providing for debenture interest, redemption of debentures, and taking into account the balance brought forward from last year, a net credit balance of £35,079 remains. From this sum the reserve fund has been credited with the sum of £8,000, leaving a balance of £27,079. The result of the operations for the past year shows a further increase in earnings on the figures of the previous year in both Cape Town and Port Elizabeth, and enables the directors to recommend a dividend of 5 per cent. free of income-tax on the ordinary share capital of the company. This will absorb £24,561, leaving £2,517 to be carried forward. During the past year the tramways in Cape Town carried 14,779,709 passengers, and the receipts amounted to £144,222, as against 13,733,656 passengers earning £135,369 for the year 1911-12. In Port Elizabeth 4,155,711 passengers were carried, earning £43,036, as against 3,747,913 passengers earning £39,823 for the year 1911-12. To meet the expansion of the traffic in Port Elizabeth, arrangements have been made to increase both rolling stock and power plant, and there is every indication of the continuance of the present satisfactory growth of the business at that port. Extracts from the reports of the general managers at Cape Town and Port Elizabeth for the year ending June 30th, 1913, are published by the directors, giving further details of the working of the undertakings. Towards the end of last year Mr. W. B. Rommel, the managing director, at the request of the board, paid an extended visit to both Cape Town and Port Elizabeth, which gave him the opportunity of discussing and arranging with the general managers on the spot many important details of the business, which it is believed will lead to further improved results in the future. The directors record the valuable services rendered by the local boards in Cape Town and Port Elizabeth, also by the general manager, Mr. J. A. Barkley, in Cape Town, the general manager, Mr. W. H. Freemantle, in Port Elizabeth, and the staffs under them.

The meeting is to be held at the London Wall Buildings, E.C., on November 5th.

Western Union Telegraph Co.—The report for the year ended June 30th states that the fiscal year will be changed to end on December 31st, and a full report will be submitted next April. In his present statement, president T. N. Vail says that the increase of $4,700,000 in gross earnings is satisfactory when due consideration is given to the general business conditions during the period under review. The principal increases in operating expenses were :—Reconstruction and depreciation, $1,652,800 ; improvements at offices and establishing new offices, $443,200 ; relief department and pensions, $124,300 ; proportion of messenger service (extending radii), $121,900 ; increase in wages, $2,488,000.—*Financial Times.*

Reduction of Capital.—The Traction and Power Securities Co., Ltd.—A petition for confirmation of reduction of capital from £2,000,000 to £1,829,180 has been presented. Particulars of claims, &c., must be sent by November 1st to R. B. Philpott, of Surtees, Philpotts & Co., 6, St. Helens Place, E.C., solicitors.

Otis Elevator Co., Ltd.—A petition for confirmation of reduction of capital from £200,000 to £68,190 has been presented. Particulars of claims, &c., must be sent by November 12th to Bristow's, Cooke & Carpmael, 1, Copthall Buildings, E.C., solicitors.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—The accounts for the year to June 30th show a gross income of $6,114,973, and operating expenses and taxes $2,963,180, leaving net earnings $3,151,792. A comparison of the gross income with the previous fiscal year shows an increase of $649,686, or 11·9 per cent., and the net earnings an increase of $329,393, or 11·6 per cent. The business of both divisions of the concern has shown a satisfactory growth, the sales of gas showing an increase of 6·9 per cent., and the sales of electricity an increase of 20·4 per cent., as compared with the previous fiscal year.—*Financier.*

Australia.—According to a Sydney newspaper, the Supreme Court at Perth has granted an order winding up the Cottesloe Electric Light Co., Ltd. The petitioning creditor said that the company was insolvent and unable to pay its debts, and that its assets, including book debts, were valued at £450.

United Electric Tramways Co., of Caracas, Ltd.—The net revenue account for the year to June 30th shows a disposable balance of £9,204, out of which the directors recommend the payment of a dividend for the year of 5 per cent. (less income-tax) on the share capital, which will absorb £8,500, leaving £704 to be carried forward.

Marconi's Wireless Telegraph Co., Ltd.—At an extraordinary general meeting held on Friday last, Mr. Marconi presiding, the resolutions already passed increasing the capital, were confirmed.

Brisbane Electric Tramways Investment Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum (4s. per share), free of income-tax, on the ordinary shares for the half-year ended June 30th.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1½ per cent. on the ordinary stock is announced

Continental.—Germany.—The Rhenisch Westfalische Electricitätswerke Gesellschaft, of Essen, is declaring a dividend of 8 per cent. for the last financial year, the same as for the preceding 12 months.

With a view of extending its plant the Liegnitz Electricitätswerke Gesellschaft, of Liegnitz, is increasing its capital from £100,000 to £115,000.

France.—La Société Electrique des Extensions Est de Meaux is the name of a new company which has lately been formed at Meaux (Seine-et-Marne) with a capital of £7,000 to establish a small electric lighting station.

A New Electrical Industrial Bank in Norway.—A new bank has recently been formed under the name of "Det Norske Aktieselskap for Elektroteknisk Industri, Norsk Industrihypothekbank," and entered in the register at Kristiania. The capital of the bank is £222,222, and it has been formed with the view of supporting the electrical industry in general by promoting new enterprises and assisting those that are already in existence and require support for increasing their activity and for extensions by means of loan on mortgage or by temporary loans, &c. It is reported that General-Director Eyde, the well-known engineer and founder of the Norwegian nitrate industry, is one of the promoters of the bank, which will start operations in the near future.

Sweden.—A new company has recently been formed at Stockholm by the A/B Stockholms Glödlampfabrik and the A/B Svensk Glödlampfabrik for the manufacture of tungsten wire according to a new patent which belongs to the former company. The capital of the new company is £2,100, and the rights of the above-mentioned patent have been transferred to the new company against a payment of £1,700 in shares to the vendors.

Switzerland.—The Aktien Gesellschaft Columbus für Elektrische Unternehmungen, with a capital of 25,000,000 fr., has been formed at Glaurus, for the financing and development of electric undertakings of all kinds, by itself or through others. The Brown, Boveri Co., of Baden, is represented on the directorate.

Monte Video Telephone Co., Ltd.—The directors report for the year ending July 31st last, states that after providing for all charges in Monte Video and London, the net profit for that period is £25,834, as against £25,120 for the previous year. The interim dividends paid on May 1st last absorbed £4,343, leaving a balance of £21,491 plus £4,315 brought forward, making an available balance of £25,806. After applying £8,500 to depreciation of the company's property and plant, and transferring £8,500 to reserve for renewals, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving a balance of £4,464 to be carried forward. The number of new subscribers during the year has again shown a moderate increase. The meeting will be held on October 29th at Winchester House, E.C.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Humphrey Pump Co., Ltd.—30,000 ordinary shares of £1 each, 10s. paid, Nos. 1 to 30,000; 100,000 ordinary shares of £1 each, fully paid, Nos. 30,001 to 130,000; and 25,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 25,000.

And to allow the following to be quoted in the Official List :—

Mississippi River Power Co.—$16,000,000 common stock; $6,000,000 6 per cent. preferred stock; and $14,500,000 additional first mortgage 5 per cent. 40-year gold bonds.

Norwich Electric Tramways Co.—A financial daily states that the accounts for the year ended June 30th show a net profit, after providing for debenture interest, &c., and including £575 brought forward, of £10,561. The directors propose to transfer £2,500 to reserve (raising that fund to £15,179), and to pay a dividend of 3 per cent., leaving £141 to be carried forward.

British Coalite.—According to a financial daily, a scheme has been prepared for reorganising the capital of the British Coalite Co., Ltd., under which the £60,000 of first mortgage 5 per cent. debentures remain untouched, and £75,000 of second mortgage 6 per cent. debentures will be created, of which about £40,000 will be issued at once. The ordinary shares will be reduced from £721,081 to £103,858, and the deferred from £500,000 to £183,108.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 7 per cent. per annum for the six months ended June 30th last, payable on November 15th.

The number of units delivered to consumers during the four weeks ended September 26th, 1913, amounted to 1,361,378, compared with 1,258,799 units in the corresponding four weeks of 1912.

Metallic Seamless Tube Co., Ltd.—The directors' report for the year ended June 30th last states that the net profits were £5,764 plus £1,740 brought forward. A dividend of 20 per cent. is recommended, and £2,887 is carried forward.

Chloride Electrical Storage Co., Ltd.—The directors have declared an interim dividend of 5 per cent. actual, free of income-tax, on the ordinary shares.—*Financier.*

Hong-Kong Tramway Co.—Interim dividend at the rate of 5 per cent. per annum for the six months ended June 30th, 1913.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange surmounted the difficult settlement last week with more ease than was generally expected, and prices, in some cases, have shown a mild tendency to recover. There has been little enough check to the fall in the securities of the utility companies operating in Mexico and Brazil, some of the Canadian properties also joining in the weakness; but, on the other hand, the acute pressure to sell good stocks has been relaxed, and the retention of the Bank Rate at 5 per cent. was hailed as a sign that the monetary position might be regarded as somewhat easier.

Stock Exchange markets are moving in vicious circles. Of these, the one which will probably appeal most to those who read this column is the heavy depreciation that has taken place in stocks and shares of all kinds, which renders the investor either unwilling, or unable, to take advantage of the many opportunities for picking up quite attractive issues at the current quotations. To buy these it would be necessary in some cases for him to sell others, which stand so much below the original prices of purchase that the sacrifice seems not worth the making, because, manifestly, were general conditions to change, the values of his existing securities would move up with everything else. Thus, the exchange would be as broad as long, save that the innate dislike of selling anything at a very heavy loss practically forces him to forego the purchase of the stock that he would like to have.

It is a dismal thing to do, but it may serve a useful purpose if we set out the comparative prices of some of the Latin-Canadian descriptions which have had such severe falls during the past few weeks. To buy anything connected with Mexico or Brazil requires unusual courage at the present time; but, unless the skies fall, some of the bonds in the annexed list must be certainly bargains. Leaving shares out of account, we take bonds only, all of them bearing interest at 5 per cent., with the exception of the Mexico Tramways 50-year issue, which is a 6 per cent. security:—

Five Per Cent. Bonds.	Price Sept. 1st.	Present price.	Fall.	Yield. £ s. d
Mexican Light and Power First Mortgage..	92	86	6	5 16 3
Mexican Light and Power 50-year Mortgage	81	75	6	6 13 4
Mexican Electric Light First Mortgage ..	82	75	7	6 13 4
Mexico Tramways First Mortgage	91	85	6	5 17 8
Mexico Tramways 50-year Mortgage ..	94	93	1	6 9 0
Rio de Janeiro Tramway First Mortgage ..	107	100½	6½	4 19 6
Rio de Janeiro Tramway 50-year Mortgage	97	90½	6½	5 10 6
Monterey Railway, Light and Power First Mortgage	77	75	2	6 13 4
Pachuca Light and Power First Mortgage..	87½	80	7½	6 5 0

In each case quoted above, we have taken the top prices in the Stock Exchange Official List. Actually, the bonds can be obtained a point or two more cheaply, and when the dates of interest payment are also taken into account, the yield will, of course, be increased. It is easy enough to buy these securities, but they are not so readily saleable in several instances.

The news from Mexico is undoubtedly bad, and even if the difficulties were to be settled to-morrow, it would take the country a long time to recover from the effects of the revolution. It is the rate of exchange which provides a factor almost as disturbing as that of the political troubles themselves. Mexico Trams Common shares have fallen 6, the Preferred 7; Mexican Light and Power are down 5, the First Mortgage bonds a similar amount. Mexican Electric First Mortgage Debenture at 72½ is 6½ lower; all these changes have occurred since we wrote last week.

The Electrical Supply market is quietly dull. Falls have taken place in the Ordinary shares of the Westminster, St. James' and County of London Companies. County Preference are also ⅛ easier, and so are Charing Cross Preference. City "Lights" Preference hardened to 13 middle. Edmundson's Preference are ⅛ down. There should be little doubt but that the *Maison Electrique* at the Ideal Home Exhibition will prove an extremely effective advertisement to the smaller consumer. One of his objections, by the way, to electric light, as opposed to gas, is the cost of the lamps; and although the recent reductions in the prices of these mark a valuable step in the direction of attacting new customers, there can be little doubt that further economies in this direction would draw an ever-increasing army of consumers. In which connection may be noted with interest the latest invention for treating metal-filament lamps of which the filament is broken or the glass blackened. It is claimed that the lamps can be renewed at a price substantially below that charged for most of the existing makes.

The Home Railway market, after being heavy, hardened up on Tuesday. Metropolitans fell to 42½, but recovered to its previous price of 44¼. Districts at 32¼ were ¾ lower, but they also rallied. No further changes have occurred in the Central London group. British Electric Traction 7 per cent. Preferred eased off to 50½. London and Suburban Preference shares and Debenture stock have both improved, and Potteries Ordinary hardened to 7s. 6d. middle.

The Telegraph market is idle. Great Northerns went back to 30, a fall of a sovereign; the other changes in the list are insignificant. Oriental Telephones recovered part of their fall of last week, and New York Telephone 4½ per cent. bonds rallied ¼. After its sharp drop, American Telephone and Telegraph capital stock steadied to 126: this represents a fall of a point on the week. Anglo-American Telegraphs are a little better. National Telephone Deferred moved up to 8½, and held its rise. Marconis have been a dull market, and with the recession in the Ordinary the prices of the subsidiaries are also lower. The report of the Canadian Marconi Company is disappointing to the many who had looked for some better sort of profit than $62 for the past financial year.

In the Manufacturing division, British Aluminium Ordinary continue to improve, and the price has risen 3/16 to 25s. British Insulated Cables eased off to 8⅜. Crompton Debentures have gained 2½. Rubber shares remain very dull, and the various kinds of remedies proposed to rehabilitate the price of the raw stuff, do not command a great deal of confidence in their being able to do more than palliate the existing condition of affairs. One of these days, of course, it will be right to buy rubber shares, but the time seems scarcely to have arrived even yet. Amongst metals, the price of copper rose sharply upon a strike breaking out on the Rio Tinto Mine; but this, though of somewhat large proportions, does not appear to be regarded seriously by those most interested in the copper share market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, October 22nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. .. "	22/-	..
a " Oxalic .. .. .. per lb.	3d.	..
a " Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. "	42/-	..
a Ammonia, Muriate (large crystal) per ton	£30 10	..
a Bleaching powder .. .. .. "	£6 5	..
a Bisulphide of Carbon .. .. "	£18	..
a Borax .. .. "	£17 10	..
a Copper Sulphate .. .. .. "	£24	..
a Lead, Nitrate .. .. .. "	£30	..
a " White Sugar .. .. "	£27 10	..
a " Peroxide .. .. .. "	£32	..
c Methylated Spirit .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	3½d.	..
a Potash, Caustic (88/90 %) .. per ton	£22 10	..
a " Chlorate .. .. .. per lb.	3½d.	..
a " Perchlorate .. .. "	4½d.	..
a Potassium, Cyanide (98/100 %) .. " (for mining purposes only)	7½d.	..
a Shellac .. .. per cwt.	100/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. "	£8 10	..
a " Recovered .. .. "	£5 10	..
a " Lump .. .. .. "	£5	..
a Soda, Caustic (white 70/72 %) .. "	£10 5	..
a " Chlorate .. .. .. per lb.	3⅝d.	..
a " Crystals .. .. .. per ton	£8 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£96	..
b " Wire, in ton lots (1 to 14 S.W.G.) "	£121 6 8	..
b " Sheet, in ton lots .. "	£126	..
p Babbitt's metal ingots .. .. "	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	8d.	½d. dec.
c " Tube (brazed) .. .. "	10⅜d.	⅛d. inc.
c " " (solid drawn) .. "	10d.	⅛d. inc.
c " Wire, basis .. .. .. "	8⅛d.	⅛d. dec.
c Copper Tubes (brazed) .. .. "	11⅛d.	⅛d. dec.
c " " (solid drawn) .. "	11⅜d.	..
g " Bars (best selected) .. per ton	£91	..
g " Sheet .. .. .. "	£91	..
g " Rod .. .. "	£91	..
d " (Electrolytic) Bars .. "	£78 10	..
d " " Sheets .. "	£96 10	..
d " " Rods .. .. "	£84	..
d " " H.C. Wire per lb.	10½d.	..
f Ebonite Rod .. .. .. "	4,6	..
f " Sheet .. .. .. "	4/-	..
n German Silver Wire .. .. "	1/10	..
h Gutta-percha, fine .. .. .. "	6/6 to 7/6	..
h India-rubber, Para fine .. .. "	8/2	2d. dec.
j Iron Pig (Cleveland warrants) .. per ton	52/1½	1/1½ dec.
l " Wire, galv. No. 8, P.O. qual. "	£14	..
g Lead, English Pig .. .. .. "	£20 15	5/- inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£7 5	..
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e " " " medium "	3/6 to 6/-	..
e " " " large .. "	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. "	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings "	1/1 to 1/3½	..
p " " rolled bars & rods "	1/0½ to 1/2	..
p " " rolled strip & sheet "	1/2½ to 1/5½	..
o Platinum .. .. per oz.	185/-	..
d Silicium Bronze Wire .. .. per lb.	11d.	..
r Steel, Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. "	£188 to £189	..
n " Wire, Nos. 1 to 16 .. .. per lb.	2/6	..
p White Anti-friction Metals .. per ton	£44 to £206	dec.
k Zinc, Sh't (Vieille Montagne bnd.) "	£25 10	£1 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ – 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ – 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 – 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 – 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ – 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8½ – 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 – 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ – 5	..	5 0 0
Do. 4½ % Cum. Pref	5	4½	4½	4 – 4½	— ⅛	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅜ – 8⅝	— ⅛	5 16 2
Do. Do. 4 % Deb.	100	4	4	90 – 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ – 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 – 97	..	4 12 9
City of London, Ord.	10	9	6†	15⅜ – 16⅜	..	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12½ – 13½	+ ⅛	4 8 11
Do. 5 % Deb.	Stock	5	5	115 – 119	..	4 4 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 – 101	..	4 9 1
County of London, Ord.	10	6	5†	11½ – 12	— ⅛	5 0 0
Do. 6 % Pref.	10	6	6	11⅞ – 12	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ – 104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 – 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ – ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 – 4⅛	..	3 8 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ – 1⅝	— ⅛	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 – 83	..	5 8 5
Folkestone	5	6	6	4⅜ – 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ – 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 – 91	..	4 19 0
Hove	5	9	..	7⅞ – 8⅛ xd	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7½ – 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 – 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 – 78	..	5 15 5
London Electric, Ord.	3	2½	..	1⅛ – 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ – 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 – 93	..	4 6 0
Metropolitan	5	4	4†	8⅜ – 8⅝	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ – 4¾	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 – 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 – 82	..	4 5 4
North Metropolitan Power Supply, 6 % Mortgages (Red.)	100	5	5	99 –103 xd	..	4 18
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 – 10⅜	..	5 11 7
Oxford	5	7	6†	6⅞ – 6⅞	..	5 9 10
St. James' and Pall Mall, Ord. ..	5	10	10†	8⅜ – 9⅛	— ⅛	5 8 1
Do. 7 % Pref	5	7	7	6⅞ – 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	83½ – 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅜ – 2½	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 – 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅞ – 1⅞	..	6 1 3
Do 4½ % First Deb. Stock ..	100	4½	4½	93 – 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅜ – ⅝	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ – 2½	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 – 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ – 8⅝	— ⅛	5 14 8
Do. 4½ % Cum Pref.	5	4½	4½	4½ – 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ – 5⅛	..	5 17 1
Calcutta, Ord.	5	1½	..	7½ – 7⅝	..	5 9 8
Do 5 % Pref.	5	5	5	5 – 5⅛	+ ⅛	4 15 8
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 – 98	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	105 –110	—5	6 7 3
Do. 7 % Pref.	$100	7	7	117 – 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ – 1⅛	..	6 3 1
Do. 5 % Deb.	100	5	5	91 – 98	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	90½ – 92½	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ – 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 – 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ – ⅝	..	Nil
Do. 6 % Pref.	1	6	6†	11 – 11⅛xd	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 –104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅜ – 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	108 –108	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	70 – 75	—6½	6 13 4
Mexican Lt. & Power, Common	$100	4	4	55 – 60 xd	—4	6 13 4
Do. 7 % Cum. Pref.	$100	7	7	81 – 94 xd	—1½	7 8 11
Do. 5 % 1st Mort. Gold Bds.	..	5	5	82 – 86	—5	5 16 3
Do. 5 % 2nd Mort. Bonds ..	100	5	5	71 – 75	—3	6 13 4
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	72 – 75	—1	6 13 4
Montreal, Lt., H. and Power ..	$100	9	10†	210 –220	—7	4 10 11
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 – 25	..	..
River Plate, Ord.	Stock	10	..	207 –217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 –107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ – 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort Deb.	100	4½	4½	99 –101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	130 –135 xd	—8	4 8 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 –107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100½–102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 –100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ – 93½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	1⅜ – 1⅝	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 –105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ – 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	96 – 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	125 –127	—1	6 6 0
Do. Collat. Trust	$1·00	4	4	92 – 94	..	4 5 1
Anglo-American Telegraph ..	Stock	3	3	62 – 65 xd	+ ⅛	4 12 4
Do. 6 % Pref.	Do.	6	6	104½–105½ xd	+ ½	5 14 0
Do. Def.	Do.	20/-	..	23½ – 23⅝	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 –104	..	4 16 2
Chili Telephone	5	8	..	7⅞ – 7¹⁵⁄₁₆	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 – 82	..	4 17 7
Cuba Telegraph	10	6	6†	8½ – 9½ xd	+ ½	6 9 9
Do. 10 % Pref.	10	10	10	14½ – 15½ xd	+ ⅛	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ – 8¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6¾ – 7¼	..	6 12 0
Direct United States Cable ..	10	4	4†	6⅜ – 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 –100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127 –130 xd	..	5 7 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75– 77 xd	..	4 10 11
Do 4 % Mort. Deb.	Do.	4	4	96½– 98½	..	4 1 8
Eastern Extension	10	7	7	12½– 13⅜ xd	— ⅛	5 9 10
Do. 4 % Deb.	Stock	4	4	94 – 96	..	4 3 4
East and S. Africa Tel. 4 % Mt. Db Mauritius Sub.	25	4	4	99½ –101½	..	3 18 10
Globe Telegraph and Trust ..	10	6	6†	11 – 11½	..	5 4 4
Do. 8 % Pref.	10	6	6	11½ – 12⅜	..	4 17 0
Great Northern Telegraph ..	10	20	5†	52 – 54	—1	5 9 0
Indo European Telegraph ..	25	18	..	57 – 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 – 85	..	5 17 8
Do. 4 % Cum. Pref.	$1·0	4	4	67 – 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	3⅜ – 3½	—⅛	5 3 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	8¼ – 8½	..	5 4 7
Monte Video Telephone, Ord. ..	1	6	6	1⅝ – 1¹⁵⁄₁₆	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ – 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98½ – 99½	+ ⅛	4 10 3
Oriental Telep. and Elec. ..	1	10	..	1⅜ – 1⅝	— ⅛	5 1 7
Do. 6 % Cum. Pref.	1	6	6	1⅛ – 1⅛	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 – 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ – 98½	..	4 1 3
Reuter's	10	10	10†	9⅝ – 10⅛	..	9 17 6
Submarine Cables Trust	Cert.	6	6	121 –124 xd	..	4 16 9
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 – 97	..	4 12 9
United River Plate Telephone	5	8	6†	6⅜ – 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 – 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1⅝ – 1⅞	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 – 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2¼ – 2½	..	4 11 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ – 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ – 9⅝	..	6 3 1
Do. 5 % Debs.	100	5	5	99 –101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	13⅜ – 13½	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 – 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 – 95 xd	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Tramways, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	15/16 — 1 1/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12½ — 14½	..	..
Do. Do. Deferred	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	8	..	49 — 52	—1	5 15 5
Do. 5 % Perp. Deb.	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	6	6†	7/16 — 9/16	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 3/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	1/16 — 3/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 1/8	+ 1/32	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	78½ — 81½	+4½	5 10 5
London Elec. Railways, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Lond n Unite) Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol.	100	1⅞	1¾†	44 — 44½	..	3 13 0
Do. Surplus Lands	100	2⅞	2¾†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	1¾	81 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	1¾	3½	76 — 78	..	4 9 9
Metropolitan District Ord.	100	Nil	..	33 — 33½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metrop. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	7/16 — 7/16	+ 1/32	..
Do. 5 % Pref.	1	5	5	5/8 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	7/8 — 15/16	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3 3/32 — 4	..	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	110 —113	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	5	3	1¼†	3 3/16 — 3 5/16	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4 13/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5⅛	5⅛	4 7/16 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	91 — 93	— ½	4 6 0
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do 5 % Deb.	100	5	5	9[illegible]½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 — 10[illegible]	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 4 4
Do. 4½ % Deb	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	—1	6 13 4
Brisbane Trams Invt., Ord.	5	8	8†	7¼ — 7⅝	+ ⅛	5 3 8
Do. 5 % Pref.	5	5	5	5 — 5⅛	+ ⅛	4 10 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	121 —124	..	6 9 1
Do. Pref. Ord.	100	6	6	109 —113	..	5 6 2
Do. 5 % Pref.	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100 xd	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	89 — 92	..	4 12 5
Calcutta Trams, Ord.	5	7½	6†	6 — 6¼ xd	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5⅛	+ ⅛	4 15 8
Do. 4½ % Deb	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1/16 — 1/8	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 13 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	18 — 28	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/32 — 1/32	..	..
Do. Pref.	1	4½d.	6	3/32 — 1/16	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1901), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$100	5	5	97 — 99	..	5 1 0
Mexico Trams Com	$100	7	7	81 — 84	—6	8 6 8
Do. Gen. Con. 5 % Bonds	..	5	5	82 — 85	—7	5 17 8
Do. 6 % Bonds	100	6	6	89 — 92	—2½	6 10 5
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅞ — 6⅛	— ⅛	8 2 8
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	—1½	5 1 0
Perth (W.A.) Elec. Tr., Ord.	1	5⅛	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100⅛	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	83½ — 90⅛	..	5 10 6
Sao Paulo Tram., Lt. and P., 5 % 1st Deb.	$100	5	5	100 —103	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4¾ — 5⅛	+ ⅛	6 13 4
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	+ 1/16	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	3/8 — 13/32	..	8 12 4
Do. 6 % Pref.	1	6	6	13/16 — 7/8	..	7 13 4
Babcock & Wilcox	1	16	..	2 13/16 — 3 1/16 xd	..	5 1 2
Do. Pref.	1	6	6	1 7/16 — 1 1/2	..	4 8 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 7/16	+ 1/16	..
Do. 6 % Cum. Pref.	1	6	6	1 7/16 — 1 1/2	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½ — 87½	+ ½	5 14 3
B.I. & Helsby Cables	5	10	..	8⅜ — 8⅝	— ⅛	5 15 11
Do. Pref.	5	6	6	6 — 6¼	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	— ½	4 14 9
British Westinghouse, Pref.	3	Nil	..	1 3/16 — 1 5/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — 1/32	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	..	11 — 11½	..	6 7 8
Do. Pref.	5	5	5	5 — 5⅛	+ ⅛	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 1/8 — 3 1/4	..	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	57 — 62	+2½	8 1 4
Dick, Kerr	1	Nil	..	1/16 — 1/8	..	..
Do. Pref.	1	6	6	3 1/16 — 3 3/16 xd	..	7 2 2
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/32	..	Nil
Do. fully paid	5	Nil	..	1 1/32 — 1 1/16	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	68 — 68	..	7 7 1
Electric Construction	1	5	..	1/16 — 1 1/32	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/8	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9½ — 10¼	..	5 14 3
Do. Deb.	100	4	4	88 — 93	+1	4 6 0
Henley's, Ord.	5	15	10†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13½ — 14¼	..	5 5 3
Do. Pref.	10	5	5	9 15/16 — 10¼	..	4 1 9
Telegraph Construction	12	20	5†	37 — 39	..	6 1
Do. Deb.	100	4	4	96 — 98	..	4 — 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1913.

Compared with the preceding month, the electrical export and import business during September showed a considerable improvement. The exports reached a total value of £445,155, inclusive of £69 830 worth of telegraphic material and cable, these figures comparing with £434,226 and £65,429 respectively in August.

The imports for September were valued at £252 741, as compared with £216.301 in the preceding month, and the re-exports, at £30 610, were some £13,000 in advance of the August total.

The exports of electrical machinery showed a gratifying improvement during the month, which was shared by most of the sections, and only, to some extent, marred by a drop of nearly £20.000 in the value of cable exports.

A general increase in values is noticeable in the imports sections of the table; indeed, the glow lamp total shows an increase from £7.600 in August to £14,196 in September.

India and our Australasian Colonies were excellent customers, as usual, but, for some unaccountable reason, Argentinean business, as shown in our returns, dropped to insignificant proportions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway, Denmark and Danish West Indies	1,082	229	94	160	2,189	429	8,630	169	650	133	168	18,153	32,086
Germany	3,418	1,264	186	47	694	45	3,943	32	107	98	146	1,191	11,171
Netherlands, Java and Dutch Indies	2,293	1,260	338	...	163	34	1,042	...	204	38	...	303	5,675
Belgium	603	867	45	19	114	32	1,881	...	96	42	1,879	...	5,578
France	4,348	32	840	14	...	192	4,426	104	27	46	51	45	10,125
Portugal	304	380	...	...	...	6	50	...	22	8	300	735	1,805
Spain, Canary Isles and Spanish N. Africa	362	...	10	...	87	14	2,769	30	...	6	172	1,595	5,045
Switzerland, Italy and Austria-Hungary	719	435	972	36	...	10	1,565	302	...	437	31	2,199	6,706
Greece, Roumania and Turkey	171	26	146	24	20	...	657	1,142	21	...	3,600	458	6,265
Channel Isles, Gibraltar, Malta and Cyprus	109	11	18	12	...	...	129	...	29	...	...	15,440	15,748
U.S.A., Philippines and Cuba	102	61	81	112	...	161	29,536	...	...	...	...	14	30,067
Canada and Newfoundland	1,763	3,995	193	492	15	237	6,662	124	580	13	1,730	7,408	23,212
British West Indies and British Guiana	201	18	94	94	...	...	...	6	29	...	111	27	580
Mexico and Central America	258	545	20	29	...	...	321	255	...	11	5	87	1,531
Peru and Uruguay	102	...	23	10	...	432	2,003	4	1,481	...	...	275	4,330
Chile	361	112	256	94	...	196	2,476	18	144	...	74	70	3,801
Brazil	1,134	777	359	559	...	273	2,253	3,437	427	23	5,007	3,330	17,579
Argentina	37	...	...	...	...	...	25	...	...	...	9	64	135
Colombia, Venezuela, Ecuador and Bolivia	252	...	3	67	...	...	345	...	...	...	...	...	667
Egypt, North Africa and Persia	953	319	98	28	...	4	2,010	...	158	12	96	884	4,562
British West Africa	252	772	...	86	...	102	436	158	19	...	86	71	1,982
Rhodesia, O.R.C. and Transvaal	3,216	168	242	459	...	...	1,250	...	71	...	35	10	5,451
Cape of Good Hope	1,107	1,766	545	387	9	590	2,038	28	2,110	17	648	660	9,902
Natal	1,153	4,406	223	359	33	123	3,932	176	40	...	54	478	10,977
Zanzibar, Brit. E. Africa, Mauritius & Aden	224	393	65	122	...	28	119	6	167	...	51	257	1,432
Azores, Madeira and Portuguese Africa	192	259	82	51	16	2	460	...	6	10	...	765	1,843
French African Colonies and Madagascar	...	...	12	...	...	...	...	...	...	...	...	11	23
China and Siam	1,773	347	440	433	55	1,518	5,965	141	77	291	3,568	1,659	16,267
Japan and Korea	496	63	192	53	...	551	10,604	6,306	3,632	30	3,036	238	25,201
India	4,591	7,580	882	3,249	129	1,557	37,432	3,943	4,935	108	1,227	817	66,450
Ceylon	295	646	114	235	...	...	210	95	136	...	823	622	3,176
Straits Settlements, Fed. Malay States, British North Borneo and Sarawak	1,157	213	399	20	62	32	6,303	284	289	...	1,295	662	10,716
Hong Kong	1,042	471	8	196	...	211	1,824	141	61	35	4	71	4,064
West Australia	267	550	46	768	13	452	395	...	15	9	697	1,998	5,210
South Australia	123	4,075	60	239	...	24	1,022	...	351	12	31	2,631	8,568
Victoria	3,610	3,822	659	1,765	282	680	3,354	120	239	3	1,670	1,376	17,577
New South Wales	1,206	16,548	614	1,579	253	1,770	6,625	1,111	1,212	184	2,112	4,458	37,672
Queensland	419	54	49	81	...	...	1,290	...	172	...	3,547	...	5,612
Tasmania	134	107	...	56	...	...	175	...	1,074	...	100	...	1,646
New Zealand and Fiji Islands	1,629	2,755	827	616	99	389	7,453	538	487	71	9,086	768	24,718
Total, £	41,458	55,323	9,235	12,551	4,233	10,094	161,607	18,670	19,068	1,637	41,449	69,830	445,155

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark	11	...	...	170	...	...	6,215	170	835	...	8,618	16,019
Germany	5,708	30,162	2,033	11,123	10,177	2,332	51,275	1,270	6,782	8,138	4,908	133,908
Holland	...	47	10	1,068	1,100	19	54	...	...	...	30	2,328
Belgium	611	1,566	828	101	113	...	3,798	...	295	...	13,082	20,394
France	93	2,440	177	1,229	163	1,280	363	4	351	4,609	1,140	11,849
Switzerland	226	944	9	...	...	347	2,053	...	...	64	26	3,669
Italy	...	4,448	...	...	103	...	35	...	...	5	...	4,591
Austria-Hungary	4	253	...	459	208	14	633	...	157	120	...	1,848
United States	7,857	2,744	694	46	727	186	15,466	25,312	497	2,130	2,232	57,885
Total, £	14,510	42,604	3,751	14,196	12,591	4,178	79,886	26,756	6,917	15,066	30,036	252,491

Additional imports: Spain, carbons £99; Canada, electrical goods £151.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	11,626	629	...	10,822	255	...	6,004	...	308	644	322	30,610

Total Exports: £445,155. Total Re-Exports: £30,610. Total Imports: £252,741.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ON CORROSION ON TRAMWAY POLES AND ITS ARREST.

By A. J. BOUSFIELD, A.M.I.Mech.E.

A Protective Coating for Corroded Tramway Poles.

The exposed situation of tramway poles, and the unmechanical lines of their structure—due to the fact that for æsthetic reasons no struts or stays can be fixed—necessitates more than usual attention being paid to their condition so that their strength may not be depreciated by corrosion.

The worst type of corrosion is seen as pitting in the form of "rust cones," which is much more dangerous than an equal amount of simple corrosion distributed uniformly over the surface of the steel.

In order to decide what form of protection to use against this evil, we must understand the cause of the formation of these rust cones, for paints which when properly applied and maintained will prevent simple corrosion, will not stop the continued growth of rust cones when once they make their appearance.

Simple corrosion is due to the action of three elements in the atmosphere, viz., moisture, carbon dioxide and oxygen acting and re-acting on the iron, first forming ferric carbonate, and ultimately ferric oxides and hydrates.

Rust cones are apparently caused by electrolytic action, and the necessary condition is a particle of mill scale, rust or other foreign body, such as metallic lead or copper, on the surface of the steel, and moisture.

The steel, the foreign body and the moisture make a tiny galvanic cell, water is decomposed, the oxygen combining with the iron to form rust, and the hydrogen is liberated, pushing the paint up in the form of a blister. The rust so formed seems to gather over and around the foreign body, which clings to the surface of the iron, moving inwards as the electrolytic action removes more iron. The result is a cone of rust pointing inwards and having the foreign body for apex.

Now this foreign body, which is the cause of all the trouble, is very difficult to remove; it may be only the size of a pinhead, and is deep in the depression left by the rust cone. The wire brush and scraper most probably leave it untouched, no matter how careful the inspection may be. With our climate there will often be quite enough moisture retained in the conical recess to start the cycle over again after the pole has been repainted.

In this connection it may be noted that, as the sun goes down, iron cools far more quickly than the air, and in so doing moisture is deposited and forms a layer between the iron and any paint which is being applied. This fact, and the varying temperature of air between one day and the next, and between morning and evening, is one of the reasons why we may get such different results when using the same paint under apparently similar conditions.

The writer has tried many and varied paints and preservatives for tramway poles, including:—

1. Lead paints mixed with boiled oil and turps.
2. Zinc oxide mixed with boiled oil and turps.
3. Patent paints having a secret basis and oil vehicle.
4. Patent paints having oil and varnish vehicle.
5. Bituminous paints.
6. Cement coating bound and waterproofed with a coat of oil paint.

Lead paint, of course, is a very poor coating for steel, especially near the coast, and its use is often the original cause of rust cones, chloride of lead being formed from the chlorine in the atmosphere, and eventually metallic lead separating out, after which electrolytic action ensues with the formation of rust cones.

Zinc oxide was tried with the idea that, zinc being highly electropositive, any electrolytic action taking place would be at the expense of the coating and not of the steel, but it was found that this coating did not wear well, zinc oxide not possessing the property of combining intimately with the binding vehicle, which soon dried out, the oxide then wearing away as a powder. Many kinds of patent paints claiming to be indestructible were tried with varying results, but no paint which was tried stopped the "rust cone" trouble.

A paint that was tried, having a tar or bituminous basis, was unsatisfactory owing to acid being present in its composition; a really pure bituminous paint gave very good results, but could not be used as it could not be painted over with a coloured paint, black being objected to by the local authorities.

An experiment was then tried with a cement coating; Portland cement was mixed with water to the consistency of fresh cream, and applied to the pole surface with a grass brush, and a second coat two or three days after the first, so as to ensure that no part of the pole remained uncovered. After a lapse of three or four days, when the cement was quite dry, the poles were painted with a good moisture-proof paint, two coats at a suitable interval being applied. The first coat was almost entirely absorbed by "suction;" the cement in drying absorbed all the moisture on the surface of the pole, and the paint rendered the cement waterproof. Experience showed that all electrolytic action had ceased, no sign of rust of any moment being observed over a long period, where, previous to this treatment, corrosion was excessive and continuous. The poles require painting at the ordinary intervals in order to keep the cement dry and firm.

This treatment is recommended to tramway engineers afflicted with the rust cone trouble on their tramway poles as an efficient—if rough and ready—cure.

REVIEWS.

Die Telephonie ohne Draht. By Dr. K. Markau. Brunswick: Fried. Vieweg & Sohn. Price 4 M. 50 pf.

In this small volume a concise but clear discussion of the subject of wireless telephony as at present understood is given. No attempt to give the fundamental theory of electromagnetic waves is made, but taking this for granted, the treatment and language are simple and easily understood even by the non-mathematical reader.

The earlier attempts at speech transmission without connecting wires are first described, including Preece's magnetic induction telephony and telephony by means of the "speaking arc" and selenium cell. Then the various modern electromagnetic wave systems are discussed and compared. These include the high-frequency arc systems of Poulsen, the Telefunken Co., Majorana, De Forest, &c., the shock excitation systems of Wien and Lorenz, and the high-frequency alternator systems of Fessenden and Goldschmidt.

The last chapter is devoted to a useful detailed description of some of the auxiliary apparatus used in wireless works, such as variable condensers, variable inductances and the different forms of detectors.

Hand-Book of Structural Steelwork. Calculated and compiled by the Technical Staff of Messrs. Redpath, Brown and Co., Ltd.

This is a new and enlarged edition of the Hand-book of Structural Steelwork which this firm have now issued for some years. It contains about 550 pages of steelwork data, most of which it would be difficult to find in such a useful form elsewhere. The book is divided into six parts, and as far as possible all the particulars relating to that class of work are placed together.

Thus, Part I deals with girders, and gives a number of tables detailing weights and safe loads for different spans for both simple and compound girders, as well as information about steel joists embedded in concrete. Part II is devoted to stanchions, the safe loads for various sizes having all been worked out in accordance with Moncrieff's formulæ. These formulæ are based on a very complete investigation of the strength of steel columns, and are finding much favour amongst practical steel structure designers. A useful application of the Moncrieff formulæ for stanchions having both ends flat is given in the form of two vertical alignment

charts on pages 200 and 201, which should prove very useful.

Part III is devoted to roofs, and contains much information as to stresses, wind pressure, and roof coverings. On page 227, an interesting alignment chart on the same principle as those already referred to is given for ascertaining the normal wind pressure acting on a roof for a given horizontal pressure and inclination of roof, this chart being based on Duchenisi's formulæ.

Part IV explains the main principles underlying steel structural work. The language used is lucid, and it should prove of great service for office reference. The tables are very full, and a separate section gives complete mathematical tables, including logarithms, antilogarithms, sines, cosines, tangents, fractional parts, &c.

Part V is largely devoted to dimensions of steel joists, angles and tees, and gives a number of perspective drawings of end angles and fishplates, stanchion caps and bases, &c., which should be of real service.

Part VI, which for distinguishing purposes is printed in green ink, gives extracts from the London County Council (General Powers) Act of 1909, and shows how these affect the safe loads and other details given in the earlier sections.

The book is well arranged, and the repetition of important notes at the foot of each table is a good feature. It should prove of great use to steel-work designers, and inasmuch as the cost of steel-work is largely influenced by the wise use of standard sections, the general public should indirectly gain from its preparation and publication.

Oil. By W. Antrobus. Manchester: John Heywood Ltd. Price 3s. 6d., post paid.

This little book is written very much in the tone of an eighteenth-century controversy, and the language might be better chosen. What, for example, are we to make of the statement that the principal object of this work is to "make it commercially possible to produce, in considerable abundance, ample motor fuels in the United Kingdom, to make us absolutely independent of any importations whatever"? We quite fail to see how a little bit of a book can do this. From another prefatorial paragraph it would appear that the book is full of useful information in a condensed form; but this information largely takes the shape of interjaculatory jottings, for it is too inconsequential. The preface commences in a way leading to the impression that oil is to wipe out coal, but in Chapter II the author has apparently found out that King Coal is still a merry old soul, and that oil at best is but the fuel for the special occasion, and more particularly so when the occasion is brief. The only serious books on oil fuel were written before oil had reached half its present prices, and in one at least the author saw deeply enough into the relation of oil to coal to prescribe a limit to the use of the fuel he was describing, which was found to exist in such a relatively small quantity.

Later, attention is drawn to the Scotch shale oil, Kimmeridge clays and other lias (*sic*) formations. And what may be vegetable limestone? Thus we might continue carping at the book, which is put together in too much of a hodgepodge to be so useful as the author expects. Before the book is finished the author fairly gives up the idea that there is so much oil in the world, and his book leaves us unconvinced as to its having accomplished what it set out to do. Chapter VIII is headed: How to Solve the Oil Difficulty, by using not coal but other materials equally abundant and as widely distributed and more easy to get.

We are then introduced to "The System," which is held up to our eyes as the solution. Its possibilities are varied and far-reaching: it will prolong our coal supplies 100 years: it reduces economies to an irreducible minimum (this looks bad, but is probably meant to mean something different): the system is Nature's system minus the waste and prodigality of Nature. There appear to be certain raw materials hovering in the background and only waiting a call to distribute blessings on us all. And thus the book continues, while "The System" still remains elusive. This manner of writing of wonders which are not brought upon the stage is truly reminiscent of Dickens, whose characters were often wont to converse on unspeakable subjects behind a veil of words in which the object was dimly pictured, yet never named. And so we reach the end of the book, and know not what lean fuel formations are those which are to make of "the system" such a world-stirring success. We judge that peat is one of the lean fuels. What may be others we fail to gather. But we should like to say that if the Navy is to rely much on liquid fuel, our coal supplies are the source whence this fuel is likely to be derived if the overseas supply is cut off. Indeed, any serious justification for the use of liquid fuel in the Navy lies in the ability to use our native solid fuels from which to obtain liquid hydrocarbons, if ever they are necessary.

SUB-STATIONS.

By W. E. H.

The word "Sub-Station" seems to carry with it the idea of roominess, and a place in which safety is made the first consideration; such, however, is far from being the case. Many networks exist on which sub-stations were planned years ago, which were then supposed to be excellent things of their kind; others have been built in the same areas of recent years, but show little or no improvement. The aim of the persons responsible for these designs seems to have been to pay out as little as possible for the construction of what is the most important place outside the central station for ensuring continuity of supply, which ought to be of sufficient size to render the handling of any pressure perfectly safe; this, however, is generally overlooked.

In most central stations one sees the greatest care exercised. Assistants are protected against contact with live parts. Switchboards are made of well-seasoned teak, have thick rubber mats, and specially designed floors of glass, and there is no metal work within yards of anything alive; yet the same job will have sub-stations that do not afford the room to house satisfactorily a brood of chickens, and the engineer will consider he has got a first-class job, free from danger, being quite of the opinion that it is impossible to get a shock, however slight.

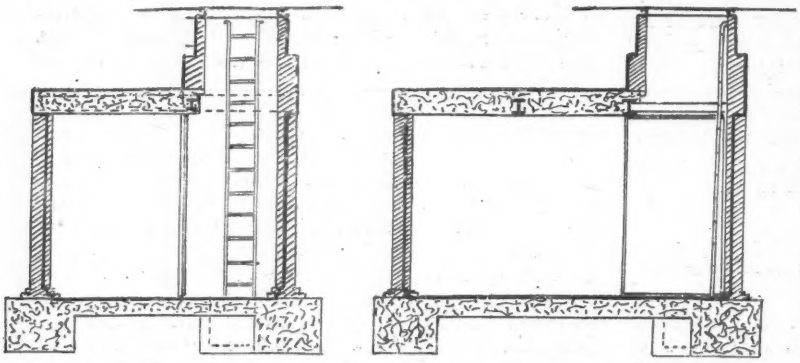
A certain system was laid down a few years ago, the usual care being taken at the works, but when the underground sub-stations were designed it was thought sufficient that they should be 9 ft. × 8 ft., with head room 6 ft. 6 in. The opening or entrance way came into the corner or centre at the side, and was about 3 ft. 9 in. square; into these sub-stations were crowded two transformers, the sizes being about 3 ft. 6 in. × 3 ft. × 4 ft. high, with two high-tension switches and two low-tension boards, which had to take four concentric distributors. However one tried to sort out and arrange the above, the fact remained that the person handling the gear was always in contact with metal cases. A carefully-laid wood floor and a plentiful supply of rubber were of no great account if one's gloves were faulty. The temperature in these sub-stations was always above 100° F.

The writer will not attempt to describe the switchgear, beyond saying that it was considered perfect. It was, however, scrapped on the incoming of a new engineer, and gear was installed in keeping with safety. Other sub-stations are at work where the area does not exceed 50 sq. ft., and in these pits are placed two transformers with the necessary switchgear. No attention whatever could have been paid to the construction; the work is poor and the materials used in the roof are very bad indeed. After every shower of rain the station resembles a shower-bath, making it unsafe to handle any gear; even in dry weather there is considerable moisture, owing to the naturally damp ground. No asphalting or water-proofing was thought necessary during construction. The above-mentioned chambers were designed during the last 12 years, after previous experience had been gained in such death-traps. The original chambers were so constructed that the attendant in charge had to enter by way of an iron ladder, passing close to the transformer, and from the ladder the high-tension switch fuse could be operated. Needless to say, trouble overtook such methods, and a separate entrance was provided. The improved sub-stations still have high-tension switch fuseboards designed over 20 years ago,

and the blowing of a fuse invariably results in setting up an arc, which does its share of damage.

These sub-stations are now undergoing a transformation, and it is to be hoped that room will be found for gear adequately to protect the persons engaged therein.

Some of the fool-proof switches designed as recently as 10 years ago were of a type that was capable of doing great bodily harm; one in particular was so constructed that the glass-panelled door of the front cover could not be opened when the switch handle was at the "on" position, a very wise precaution. The handle for operating the switch was placed on the underside in the centre, and so arranged that the case was gas-tight. To operate the handle, however, it was, in consequence of the confined space, almost necessary to stand in front of the glass panel. The fuses, also inside the case, were of the cartridge type, with fibre body and brass contact pieces. On one occasion the writer was in a sub-station equipped with this class of switch, when the assistant in charge on closing the switch was almost carried off his feet by an explosion which blew out the glass front.



Longitudinal and Transverse Sectional Elevations of Sub-station.

On another occasion a similar explosion occurred; this time an arc was set up which destroyed the switch and some feet of the cable leading to the transformer, and was only stopped by switching off the feeder at the central station. A third explosion resulted in blowing out the front of the switch, and one of the fuse caps was carried across the station with such force as to crack the porcelain tiling of the sub-station; fortunately for the assistant, he stood slightly to one side before operating. After the above accidents, and as a precaution against further trouble, the glass fronts were removed, the bomb-like fuses were abolished and ordinary copper fuse wire was substituted.

The cost of a sub-station thoroughly well built and provided with a separate entrance chamber, and having a floor space of 90 sq. ft., with a clear head-room of 7 ft. 6 in., constructed of 9-in. brickwork with concrete roof, lined with two layers of asphalt, finished off with 4½-in. glazed brickwork, and fitted with ventilating shafts, ventilating frame and cover, with earth-plate and earth strip on three sides of the chamber, would be about £250 in London.

This size of sub-station allows of four 100-kw. transformers of the Berry type being placed at one end; thus the whole wall space of the two sides is available for high and low-tension switchgear. This station gives ample room for switch gear sufficient to control six or eight high-tension circuits feeding a set of insulated bus-bars, besides transformer switchgear. The opposite wall, on which are mounted the low-tension switches, is capable of accommodating up to 14 sets of double-pole controlled distributors and four sets of transformer switches.

The whole, when complete, makes a very neat job, and is suitable for a network where lighting is the principal load.

Lamp Litigation.—Having been asked for the name of their solicitors with a view to infringement proceedings, Messrs. Pope's Electric Lamp Co. announce that they give their clients their absolute assurance that their indemnity holds good against all risk of action and damages.

THE BRITISH ASSOCIATION.—VI.

The Electric Arc as a Standard of Light.

By J. F. Forrest, B.Sc.

(*Section A. Abstract.*)

M. Blondel and others have investigated the suitability or otherwise of the intrinsic brilliancy of the crater of the electric arc as a standard of light. The conclusions arrived at by these experimenters may briefly be given as the basis on which the author's work has been built.

M. Violle suggested that the light was independent of the current and arc length. M. Blondel confirmed this, but came to the conclusion that the light was affected by the presence of impurities in the carbon. The carbons used by M. Blondel were, however, of a kind which would not, at the present day, be considered good varieties, their ash amounting to as much as 2 per cent.

Mr. Trotter noticed that the crater of a hissing arc appeared to consist of a bright line or comma, which was rapidly revolving.

Prof. Petavel found that the light was not independent of the current density. In view of the author's experience with a two-carbon arrangement, not unlike Prof. Petavel's, it seems as if he was not observing the true crater.

A three-carbon combination is in use at the present time. The negative carbons at first were inclined to the horizontal, but the horizontal position completely eliminates the tendency of the arcs to climb up the negative electrodes. The carbons are all turned slowly by hand. There being but two negatives, they are easily controlled, and, when both arcs are silent, a large steady crater is formed on the end of the positive.

When the arcs are hissing the crater is no longer quiescent, but suffers violent changes of temperature and configuration which it is impossible to describe. While hissing is actually heard the bright revolving line or comma, described by Mr. Trotter, can readily be seen by using a stroboscopic method of observation, but it almost certainly disappears with the silencing of the arc. A telephone, connected across the terminals of a low resistance carrying all the current, affords a ready means of listening to the note emitted, without the distraction of outside noises. Starting with a loud high-pitched note, the volume of sound and the pitch of the note become less and less until the limit of audibility is reached. At the same time, the speed of rotation of the arc gets lower and lower until it is visible to the naked eye. The cessation of sound and of rotation of the crater are apparently simultaneous. The area of the crater is approximately proportional to the current. The current density is 1·5 amperes per square millimetre; this uniformity is what one would expect.

The intrinsic brilliancy is independent of the current and of the nominal current density. The figure obtained—162 candles per sq. mm.—compares with Blondel's 163-158·4, and with Petavel's highest, 160.

Special Electra carbons are undoubtedly the best; they are also the dearest. In any case, the results are close enough together to encourage one to investigate further with those grades of carbons which are found most suitable.

The Improvement and Unification of English Waterways.

This subject was dealt with in Section F by several authors. Lord Shuttleworth recalled the circumstances under which a Royal Commission was appointed in 1906 to inquire into the inland waterways question in the United Kingdom. After four years' labours, they reported on English waterways, contrasting their disunited and unimproved condition with the results of unification and improvement of this system of transport in foreign countries, and recommending the appointment of a Central Waterway Board to deal with waterways, much as the Road Board deals with roads, without undertaking the business of carrying.

The Commission had done its part, and it now rested with the traders and their organisations to press the recommendations on Parliament and the Government, in the form of step-by-step improvement—first, the formation of the Waterway Board; secondly, unification; and thirdly, the first instalment of improvement of one or two of the main routes of waterways. To answer doubts, he pointed to the present obsolete condition of our canals, and the undeveloped state of our rivers, as well as the fact that we had a fine network of connected waterways in England, but remaining unimproved since 1830, in contrast with those in Northern France and Southern Belgium, where the results of unification and improvement during recent years should be visited and studied, as well as the statistics of increase of waterway traffic, accompanied by simultaneous increase of railway traffic also. In England, not only would the railway traffic be similarly increased by the development of the output of inland factories, thanks to a cheaper transport of raw materials, &c., but the transfer of industries to the coast and subsequent loss of railway rates would be arrested.

After quoting from the anticipations of the Commission of indirect return on the probable cost of unification and improvement in the shape of benefit to trade, he pointed out that the perseverance of France, Belgium and Germany year by year in the policy of

waterway improvement proved that experience had convinced foreign Governments of the benefit to trade resulting from waterway reform and extension.

Sir J. P. Griffith read a paper advocating the improvement of the nation's waterways by the State, and said that he regarded the proposals of the Royal Commission as reasonable and practical. The opposition came mainly from the railway companies, but there was reason to believe that these would themselves be able to make profitable use of the canals. Public opinion with regard to State aid of means of transit was undergoing a change, and interest in inland navigation would develop as the need for improved facilities was felt.

Mr. F. R. Durham dealt with Continental waterways, and pointed out that in France an expenditure of over 25 millions sterling on canals and navigable rivers was contemplated. The average rate per ton-mile in France on the waterways was 0·235d., and on the railways 0·7d. A programme involving the outlay of 30 millions sterling was in progress in Germany, and would be completed in 1915.

Mr. R. B. Dunwoody reviewed the English waterways, which aggregate 4,053 miles in length, and in 1905 carried goods worth 37½ millions. But only 2,400 miles were now in use, carrying 32 million tons a year, of which coal formed 45 per cent. The net revenue in 1905 was £308,000. The whole of the routes could be brought up to the 100-ton standard, and some of them could be made to carry vessels of 300 or 600 tons. At present the freight charge for water-borne coal between the Leicestershire coalfields and London was 0·55d. per ton-mile, almost as much as by rail; under improved conditions this could be reduced to 0·27d. per ton-mile.

Mr. W. M. Acworth read a paper to show that canals as a means of transport were necessarily and inherently inferior to railways; that canals could not carry cheaper than railways if the total cost of carriage was taken into consideration; that canals could only compete with railways if, as in France and in Germany, the competition was subsidised and a large part of the cost of canal carriage laid on the shoulders of the taxpayer, and that therefore a forward canal policy had no economic justification.

The writer pointed out that in England, where canals and railways had been left to compete on equal terms, the canals had been definitely beaten; that in America the bulk of the canals had been abandoned, and even the Erie Canal, though maintained as a free highway at public expense, had lost all its old importance; that in France, not only were the canals free highways maintained at public expense, but the railways were forbidden to reduce their rates to the canal level, and still the average total ton-mile cost was higher on the canals than on the railways.

From Germany figures of the important Dortmund-Ems Canal were given to show that its construction had resulted in an economic loss to the State, and only a small gain to the individual trader.

It was pointed out that canals were necessarily inferior to railways as a means of transport, because their capital cost was higher, their carrying capacity was smaller, they only catered for low-class goods in bulk, and they could only reach the ultimate point of production or consumption by the supplementary use of wagons or railway trucks.

It was also pointed out that the traders and localities for whom canals were potentially available naturally had an interest in promoting their construction by public enterprise, as thereby they, paying only a proportion of the total cost of carriage, threw the remaining half of the cost on the public at large, and so not only reduced their expenses, but obtained a differential advantage over competitors to whom the railway only was accessible.

The writer concluded that the adoption of a forward policy could not be justified as in the interest of the community at large.

In the discussion which followed, Mr. Impey questioned Mr. Acworth's statements, but Mr. Jebb said the proposed expenditure of 17 millions could not be justified on economic grounds. Mr. Boddington said that trains of small barges were preferable to large boats, and the locks need not be lengthened, but should be widened only. Mr. J. A. Saler said that water carriage was the most economical method, and a cheaper means of conveying goods from the Midlands to the coast than by rail was necessary. Mr. N. Chamberlain supported the recommendations of the Commission on the ground that the country as a whole would benefit. The extensions of the Continental waterways proved that canals were not obsolete, and the formation of a Waterway Board would be of great advantage to the trading community, even if no improvements were carried out.

In Section G, Mr. L. Blin Desbleds described a method of propelling barges on canals by means of aerial propellers, which are exempt from the difficulties experienced in connection with the use of submerged propellers in shallow and narrow waterways, or where the water is weedy. An efficiency of 16·7 per cent. has been obtained with this system, which, it is claimed, will reduce the cost of haulage by more than half compared with horse haulage, and will not cause erosion of the banks of a canal. The machinery would be installed on deck, but in order to pass through low tunnels or bridges the apparatus can be lowered to only a few inches above the deck.

Radio-elements as Indicators in Chemistry and Physics.

By G. Hevesy, Ph.D.

(*Section B. Abstract.*)

By means of an α-ray electroscope of ordinary sensitiveness it is possible to measure accurately as small a quantity as 10^{-12} grm. of a radioactive substance having a half-value period of one hour. The extraordinary simplicity and at the same time sensitiveness with which it is possible to measure these extremely small quantities of radioactive bodies makes them of the greatest use not only in studying substances in great dilution, but also as indicators of physical and chemical processes.

If 1 mg. of lead is mixed with a quantity of radium D which gives 10,000 units of activity in an electroscope, one-millionth part of this mixture is easily detectable by the radioactivity of radium D. In this way 10^{-6} mg. lead is quantitatively determinable. By this method also the solubility of the difficultly soluble salts of lead such as the chromate and the sulphide has been determined. Further, the amount of lead chloride entrained by a precipitate of silver chloride after washing the latter thoroughly with water is measurable.

The Inflammability of Coal Dust in Air.

By Prof. W. M. Thornton.

(*Section B. Abstract.*)

A mixture of coal dust and air requires a certain minimum quantity of dust to be in suspension per unit volume of air before flame can travel through it by self-ignition. Its sensitiveness to ignition can be measured by the magnitude of the least electric current which can cause ignition of the cloud. The presence of even ½ per cent. of gas has effect in raising the probability of ignition of coal dust in air.

The present paper is an account of experiments made to find the least current which will ignite a mixture of dust and gas, the percentage of gas in this case being kept constant in the successive trials whilst the circuit is broken with different currents flowing.

The results obtained with Newcastle coal gas are given in the following table and in fig. 1:—

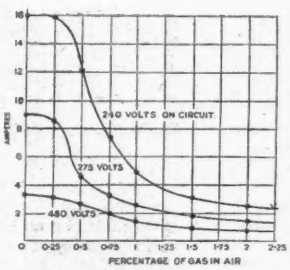


Fig. 1.—Least Igniting Currents for Clouds of Coal Dust in Air with Coal Gas present.

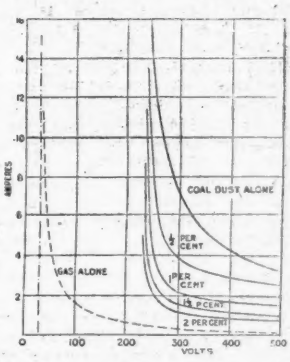


Fig. 2.—Relation between Voltage and Least Igniting Current of Coaldust with Gas Present.

TABLE I.—Least Continuous Current to Ignite a Cloud of Coal Dust raised in Mixtures of Coal Gas and Air.

Percentage of gas in air.	Voltage. 240 Amperes.	275 Amperes.	480 Amperes.
0·0 ...	16·0	9·0	3·5
0·5 ...	12·0	9·0	3·0
0·75 ...	7·5	4·0	—
1·0 ...	4·75	2·5	1·5
1·5 ...	3·4	1·8	1·0
2·0 ...	2·7	1·5	0·8

There is at each of the three voltages a definite relation between the least igniting current and the percentage of gas. The height of each curve is the least current which at the given voltage and percentage of gas causes a full ignition, and it is seen from the figure that ½ per cent. of gas has little or no effect in forwarding ignition, though with more than this there is a rapid increase in sensitiveness.

The same result is obtained with pit gas. The values obtained were as follows:—

Voltage 480 Throughout.

Percentage of pit gas in air ...	0	½	1	1½	2
Least igniting current in amperes ...	2·8	2·4	1·6	0·7	0·50

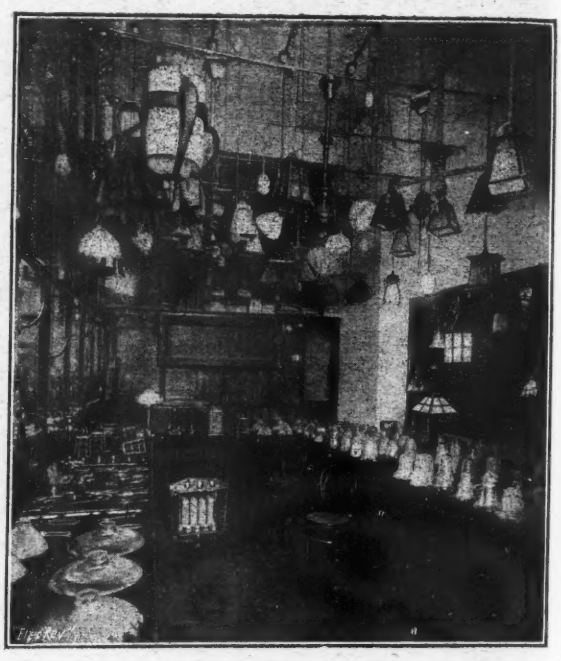
Comparing these with the coal-gas curves of fig. 1, it is seen that coal gas has slightly more effect in helping the ignition of the dust than pit gas.

Another view of the results which brings out several significant points is obtained by drawing the curves to a voltage base line as in fig. 2. There is now seen to be a voltage (about 200 in this case) below which ignition of clouds of dust, even with 2 per cent. of gas present, is exceedingly difficult. The nest of curves is symmetrical about a line drawn through this point on the base and through the nearest point on the "no-gas" curve. This would, therefore, appear to be about the highest voltage which may be regarded as relatively safe in a gassy and dusty atmosphere where the percentage of gas is not above 2, and where very large open flashes are not possible.

Although the gas has so great an influence in forwarding the combustion, it is very clear that the dust is still the dominant factor in the explosions, for the set of curves fits symmetrically under that in which no gas is present. This could not occur if the gas were the more important, for the zero voltage of the characteristic voltage-current curves for gases alone is about 25; and if the gas were the more effective, these curves should be symmetrical to that voltage as an axis, and this is not the case. The gas must be regarded as the auxiliary, not as the principal, in the ignition of the combined mixture of gas and dust at low percentages.

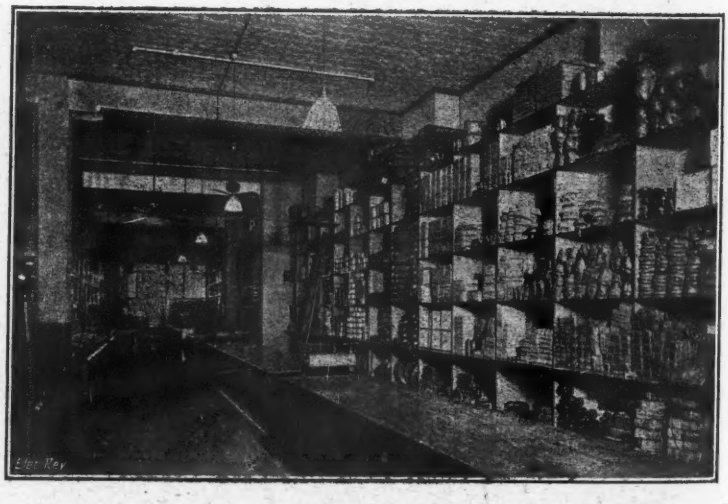
AN AUSTRALIAN ELECTRICAL STORE.

As will have been gathered from our occasional references to the statistical returns of Australian imports, the electrical requirements of the market are very large, and are constantly increasing. Manufacturing of certain classes of machinery and apparatus is carried on in several States, but only to a very limited extent, therefore the great bulk of the goods used for lighting and power service are imported from either this country or the European Continent, or else from the States. In the case of a market so far distant, one of the essentials of successful business is the ability to carry large stocks, owing to the long time occupied with correspondence and transport. And the carrying of large stocks implies the need of a thorough acquaintance with the local requirements of the many classes of purchasers from West to East of the Continent if there is to be successful selling, while it also suggests the necessity for an intimate knowledge of the newest, best and cheapest articles that are being turned out in the great electrical manufacturing centres of the world. The opening of a Colonial electrical store is not to be lightly undertaken. It is most frequently a success when it is done by enterprising men engaged on the spot in some more or less allied occupation which permits of their watching their opportunity and knowing just how and when to launch out. Some of the largest trading concerns in the Antipodes have been built up brick by brick, so to speak, by practical men who have opened a small shop, known how to wait, and have not minded taking off their coats when emergency has placed an opportunity in their path. There is, perhaps, not so much of this sort of thing happening in Australia to-day as was the case several decades ago, for in most of the big centres —Melbourne, Sydney, and so on— many thoroughly established businesses exist which have extensive headquarters from which they serve sub-departments or agents who are on the look out for trade for them in less important towns and districts. One of the well-known businesses in New South Wales is shown in the accompanying photographic views, which represent some of the departments at the store of Messrs. W. G. Watson & Co., Ltd., electrical engineers, suppliers and contractors, in Clarence and Kent Streets, Sydney. Here, as the pictures show, there is large accommodation for displaying and trading in all kinds of electrical apparatus for lighting and power, instruments, electric heating and cooking apparatus, vacuum cleaners, arc lamps, meters, cables and wires, electric lighting sets, motors and other machinery—indeed, every likely requirement for either domestic or industrial electrical service. As many of our readers are already aware, Mr. Watson has been in London for the past few months, and he has opened an office here.



A Sydney Fittings Showroom.

An Australian Electrical Store.



An Australian Store: Counter Trade.

Fireproof Trains.—The Great Western Railway Co. is running two experimental fireproof trains between London and Windsor. The trains each consist of four coaches—first and third class. The coaches are entirely of steel, with asbestos floors, and are lighted throughout by electricity. Instead of seating six, as hitherto, the first-class carriages each seat eight. The coaches are kept coupled, as the electric-light wires run the entire length of the train. The footboard appears to be the only wooden part of the train, and this has been cut down to the smallest dimensions. In case of fire it could easily be knocked away.—*South Wales Daily News.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Paraffin-Electric and Pumping Set.

Messrs. Boulton & Paul, Ltd., of Norwich, have recently constructed the lighting and pumping set shown in fig. 1 for an auxiliary schooner, under the directions of Mr. James A. Smith, naval architect. The set consists of a 2-h.p. paraffin engine directly coupled to a dynamo, which is to charge the batteries for lighting the yacht, and also supply current to electric deck winches. At the commutator end of the dynamo the shaft is extended, and drives through reducing gear an air compressor, also a small "Bam" type bilge pump, which is clearly shown in the view; the gear box is fitted with silent chains in place of spur wheels to reduce the noise to a minimum, and with a small throwing-in clutch so that the dynamo can be run without the compressor when not required. Another point of interest in connection with the set is that provision is being made for a long jacketed exhaust pipe, around which water is to be circulated by an independent pump. This water is forced through small radiators in the cabins for heating purposes. The firm specialises in such plant as that illustrated, and is publishing a new catalogue in regard to its engines, dynamos, pumps and air compressors.

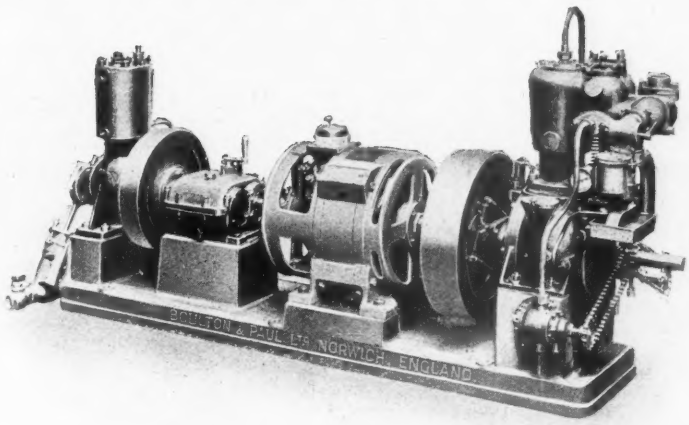


Fig. 1.—Combined Paraffin-Electric and Pumping Set.

The R.U.V. Steriliser.

The Westinghouse Cooper Hewitt Co., Ltd., of 80, York Road, N., have introduced an ultra-violet ray water steriliser suitable for domestic purposes, as illustrated in fig. 2; this device has an output of 22 gallons per hour, and needs no attention. It can be used on all d.c. voltages from 100 to 250 volts, but requires a special converter where the supply is alternating. In starting, the switch is closed and the water supply turned on; the lamp is then tilted and allowed to return to its normal position. Should the electric circuit be broken, an automatic valve closes the water supply, to prevent unsterilised water from passing through. Apart from the effective sterilisation, the water is absolutely unaffected by the process. Type B5 takes 2 amperes. As ordinary filters are often disease disseminators rather than water purifiers, the ultra-violet ray steriliser should be heartily welcomed as a valuable addition to our hygienic resources. The apparatus is of handsome appearance, and is very suitable for use in hospitals and works, as well as for domestic purposes.

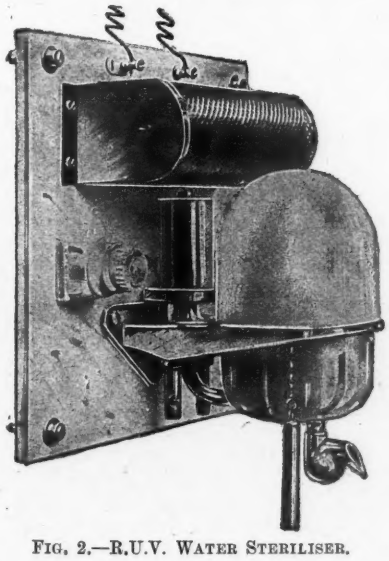


Fig. 2.—R.U.V. Water Steriliser.

The "Losles" Water Heater.

Mr. George Wilkinson, of Beech Mount, Harrogate, has introduced a new automatic electric water heater, known as the "Losles," which we illustrate in fig. 3. This heater takes a small current for a long period, thus securing the benefit of specially low charges; all the connections and heater pockets are fixed upon the bottom of the water chamber, so that there is no metallic connection between it and the outer casing, and the intervening space is packed with a heat-insulating material of exceptionally high efficiency. A simple thermostat influenced by the temperature of the water controls the electric supply, and adequate provision is made for installing the apparatus with ease, and sealing up all the electrical parts. The standard size is of 12 gallons capacity, which is sufficient for a 25-gallon hot bath, its dimensions being 36 in. high × 15 in. diameter; two heaters are provided, each taking about 500 watts at 200 to 230 volts. With one heater in action, the maximum output is equivalent to 24 gallons of boiling water per 24 hours, and with both heaters the output is doubled. The temperature of the water may set at anything from 160 to 200° F.

Fig. 3.—"Losles" Water Heater.

Improved Wireless Receiver.

Messrs. Whitford & Co., of Grosvenor Road, Ilford, Essex, have introduced the "Ford" receiver, specially designed for wireless work, and wound for resistances from 1,000 to 6,000 watts. These receivers are light, neat and of high efficiency, and are carried on special-tempered spring steel headbands; we illustrate in fig. 4 one of the double type, of which we have received a sample for inspection. The workmanship is excellent, and the design allows of very fine adjustment of the diaphragm to the magnet poles.

Fig. 4.—"Ford" Wireless Receiver.

Royal Ediswan Daylight Lamp.

The Edison & Swan United Electric Light Co., Ltd., of 36, Queen Street, E.C., has introduced the Royal Ediswan Daylight Lamp for use in colour matching. With the metal-filament lamp burning at a high efficiency, shades of blue or green can be compared, but the results are still very far from satisfactory in the reds. By the adoption of a specially tinted bulb for the metal-filament drawn-wire lamp the violet rays are stopped, and an effect is obtained equal to that of daylight. The lamp is known as the "Royal Ediswan Daylight Lamp," and by its use tests show that colour matching of the most delicate shades and tints in draperies, silks, papers, &c., can be carried on with almost as much ease and exactness as by daylight. It is also a capital reading lamp and restful to the eyes.

New Indicator.

Messrs. Gent & Co., Ltd., of Faraday Works, Leicester, have recently introduced the new indicator movement, shown in fig. 5. The instrument is strong, but very sensitive in action. The swinging pendulum is composed of one part made of a stout iron stamping, and swings on knife edge bearings giving exceptionally long swings. There are no light or delicate parts about it, and it

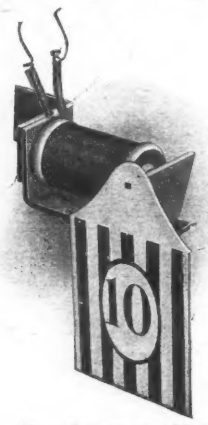


Fig. 5.—New Indicator Movement.

is claimed to be impossible to put it out of adjustment in any way. We believe Messrs. Gent were the original designers of pendulum movements, having introduced their first pendulum indicator in 1879, and since that date many other striking designs. The new movement is, however, an advance on its predecessors, and it has the great advantage of being exceptionally cheap; it is made throughout at the firm's works at Leicester.

B.T.H. "Fostoria" Table Lamps.

One of the most novel and interesting lighting appliances for the development of which the British Thomson-Houston Co., Ltd., have recently been responsible, is the "Fostoria" table lamp, which represent, a complete departure from traditional table standard designs.

These lamps are made of glass—either white veluria or tinted iris—moulded into quaint shapes and etched with pretty designs. Both the pedestal and the dome or reflector are made of glass.

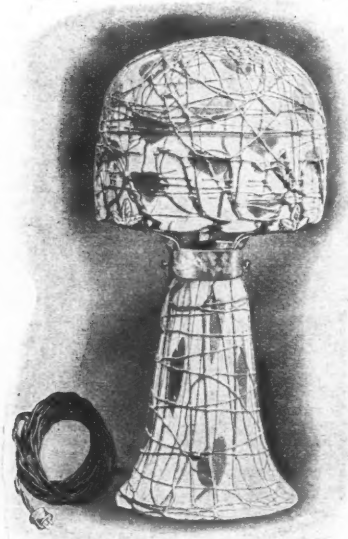


Fig. 6.—B.T.H. "Fostoria" Table Lamp.
(For one Mazda lamp under dome, and one in pedestal.)
Made of Iris golden glassware.

Beautiful effects are obtained by using, in the case of three out of the four available types, a small lamp in the pedestal as well as under the dome. The B.T.H. "Fostoria" table standards are an agreeable change from the metal standard and silk-shade convention, which has been rigidly observed since oil-lamp days. They can be seen at the B.T.H. Co.'s showroom, Mazda House, 77, Upper Thames Street, E.C., or on the stand of Messrs. Godfrey Giles & Co. at the Ideal Home Exhibition.

Reyrolle Wall Plugs.

Messrs. A. Reyrolle & Co., Ltd., Hebburn, have introduced a line of wall plugs for domestic use, in which the terminal pins are so guarded that they cannot be touched when alive, as the frame of the plug is made to fit over the socket like a spigot and socket joint. Secondly, the plug and socket provide proper arrangements for earthing in such places as bathrooms and scullieries, where electrical apparatus is used in close proximity to water pipes, &c. The plug is somewhat heavier than one generally associates with domestic work, but its elegance in design permits of its use, and thanks to that feature and its good finish, it is not unsightly or out of place in living rooms.

Electric Clock Movements.

Regarding the spring device described under this heading in our last issue, the Magneta Time Co., Ltd., of Chatham House Works, Turnham Green, Chiswick, write pointing out that it formed the subject matter of one of their early patents, the specification of which is before us.

ELECTRIC WINDING IN SCOTTISH PITS.

Electric winding is coming more and more into favour. It is cheaper than steam; the plant as improved is compact and easy to operate. There is a great saving in first cost, as the rotary converter, driving motor, control gear, and winding apparatus cost very much less than boilers and steam engines; and the reduced winding costs and lower depreciation and interest on capital represent quite an appreciable reduction in the cost per ton of coal raised.

One engineering firm—Messrs. Crompton & Co.—have patented a system which is proving exceedingly satisfactory in practice. Two winding installations in Scotland have just been completed on the Crompton system. The rotary converter has an unusual method of starting. A triple-pole switch is used with resistance units permanently connected across the terminals, the resistances being such that a current sufficient to start the rotary without a load is obtained. Closing the main oil switch on the transformer circuit therefore starts up the rotary, and when the latter has got up speed, the closing of the triple-pole switch short circuits the resistances and provides full current.

Two sets of winding apparatus are being fitted at the pits of the Mount Vernon Colliery Co., West of Scotland; and at Messrs. Dunn and Stephens's South Kenmuir Colliery, an electric winding plant is now in full operation. Both plants are on the C.M.B. system. The Dunn & Stephens pit has gear for a working depth of 160 fathoms, the present depth being 90 fathoms. The cages carry two hutches apiece, the loaded hutches taking 17 cwt., which, with 65 winds per hour, represents 55 tons of coal. The ascending load totals 57 cwt., and the descending load 23½ cwt., leaving 33½ cwt. to be dealt with by the winding gear. To deal with this load a 120-kw. motor-generator working at 400 volts is employed, the two winding motors being each of 150 b.h.p., and running at 400 r.p.m. On test the maximum demand from the mains was a little over 120 kw., while the units per ton working from an 85-fathom level, were only 0·8, which, with energy supplied at ¾d. per unit, gives the winding cost per ton at the low figure of ·6d. (without capital charges). The average winding speed of this plant is 1,120 ft. per minute, and the maximum, 1,360 ft., with an acceleration period of 8 seconds, a full speed period of 29 seconds, and a retardation period of 8 seconds. The banking time is 10 seconds, and the time taken for each wind is 55 seconds. With a day of eight working hours, on this basis, the lift is 440 tons.

The power supply in the South Kenmuir district is three-phase alternating, 25 cycles per second, voltage 440. This is directly coupled up to the rotary converter through a triple-pole oil switch with overload circuit breaker attachment, while the motor has a wound rotor with slip rings for starting, a liquid starting resistance being employed. The alternating circuit panel has mounted on it the usual volt and ampere meters, and also a voltage coil which connects the leads to the emergency trip gear of the brake.

The main winding drum is of the spiro-conical type, designed to minimise the torque during acceleration. Control is by a regulator in the field circuit of the motor-generator, and by a reversing switch in the winding-motor circuit, the two switches being connected so that before the motor can be reversed the current must be shut off and the brake applied. The magnetic brake is automatically applied as the controller is brought back, but comes into action should any electrical failure occur. There is also an emergency brake actuated by a pedal should the supply from the mains fail. There are limit switches operated by the depth indicator which is geared to the winding drum. The operator notes the exact position of the cages at any moment, and during the actual wind has only the controller to handle, and the depth indicator and motor-generator ampere meter to watch.

The reversing switch is only moved at the end of each wind, and charges over the connections without opening the motor circuit, the cages being always held in position electrically, the armatures being short-circuited, and the motor circuits fully excited during the actual moment of changing over. Pilot contacts are provided on the reversing switch, which are coupled up through the limit switches and the voltage coil on the motor-generator controller to the exciter. If the reversing switch is wrongly used, the controller then returns to the "off" position, and sparking on heavy currents is stopped. These pilot contacts acting with the limit switches, also allow the gear to be reversed should the cage have been allowed to run too far.

At a meeting of the Mining Institute of Scotland, held in Edinburgh on Saturday last, Mr. Willoughby M. Dunn read a paper descriptive of "The Electrical Winding Gear at South Kenmuir Colliery." The author said that when it was determined by the firm of which he was a member, to re-open and equip South Kenmuir Colliery for winding coal, a difficulty arose from the fact that the space available for the usual steam plant was too limited. As electricity could be obtained at a reasonable figure from the Clyde Valley Electrical Power Co., owing to the proximity of their mains, the idea of utilising this power for winding, &c., presented itself. An estimate of the cost of a steam winding plant was made out, and a schedule of particulars was sent to the various manufacturers of electric winders for their prices and guarantees, and it was found that the cost of steam winding, on a basis of 110,000 tons per annum, worked out at 2·958d. per ton, while the electrical winding on the same basis cost only 1·938d. per ton. Further, the estimated cost of the steam equipment was for good second-hand plant, while the electrical installation was new plant. The electric system which found most favour was put forward by Messrs. Crompton & Co., Ltd., Chelmsford, with whom the order was placed.

From tests made and figures ascertained, the writer believed that this winding gear was capable of winding 720 tons per shift, or 180,000 tons per annum, from a depth of 76 fathoms, at a total cost for wages, stores, power and allowances for depreciation and interest of £910. That outlay on the basis of 180,000 tons per annum gave a cost of 1·123d. per ton. Over a certain period the results obtained were:—Output of minerals, 29,605 tons; total energy consumed 26,438 units; energy consumed per ton, ·893 unit. The time taken to wind 17 cwt. from the 76-fathom level was 24 sec., plates to plates, and with 10 sec. allowed for banking, the winder, if it were kept running without a halt, was capable of raising 720 tons from that depth in eight hours. The safeguards in the winder which has been installed were four in number, viz.: (1) There was an electromagnetic brake which came into operation at the end of every wind; (2) on the indicator column there were trips which came into operation immediately after the limit switches were tripped, and applied the mechanical brake by the release of a heavy weight; (3) this weight was also released to apply the mechanical brake by means of a solenoid connected direct on to the supply mains, which came into operation in the event of the current supply failing; and (4) the mechanical brake was operated by means of a cramp at the engineman's foot.

No difficulty had been experienced in training men to work the winder—ordinary winding enginemen being employed. It was also admitted by those who had travelled on the cage, that the ride was a much more steady one than that experienced with the steam winding engine.

NEW LABORATORIES AT DUNDEE.

Sir Alexander B. W. Kennedy, LL.D., F.R.S., on Tuesday 14th inst., formally opened the new engineering department at University College, Dundee, which has been erected at a total cost, including equipment, of £15,500. The new department forms an L-shaped block, and the main building, forming the north side of a quadrangle, is two storeys in height, broadly treated in a domestic form of classical design and roofed with a steeply pitched roof of grey slate. This contains the lecture rooms, drawing offices, library, private rooms, and hydraulic laboratory, with two rooms set apart for a possible future architectural department. An architectural feature is provided by the central tower, some 80 ft. high, which accommodates the fan and machinery for the forced ventilation of the building, and also contains a storage tank of 10,000 gallons capacity, from which the mains in the hydraulic laboratory are supplied. In the lower storey are accommodated the heat-engine laboratory, and the boiler-house; the strength-of-materials laboratory; the cement-testing room, and the workshop. Owing to the completion in 1910 of the Peters Electrical Laboratory, the college is well equipped for the study of this branch of engineering, and the present laboratories are devoted to the investigation of problems involved in civil and mechanical engineering. Sir Alexander Kennedy gave a valuable address on engineering education, in the course of which he observed that, as regarded the general trend of our academic training, he thought engineers were entitled to ask that it should be so arranged as best to train the best engineers. He put it in that way because he meant it to be understood that while on the one hand the best engineer was certainly not the man who knew his own business only and narrowly, on the other hand, he thought they were entitled to demand that the engineer should not be looked upon as the mere by-product of the training, but as the chief result to which other things were to be subordinated. In saying this, however, he particularly did not mean that the academic training of engineers should be laid out on superficially utilitarian lines.

The idea of giving a young man just as much mathematics, just as much physics, or just as much chemistry as he could professionally require, was not only pernicious, but absolutely fallacious. He was sure that the only way of learning a subject up to a certain point, in such a fashion that up to that point it could be thoroughly utilised, was to study the subject up to a point very much further advanced. It was not at all a valid objection to the teaching of any particular point in mathematics or physics that it was more complicated or more advanced than anything which the engineer would be likely to require. It was desirable, indeed necessary, from their point of view, that the advanced work in purely scientific subjects should be specially chosen so as best to deepen and make certain the knowledge of the earlier work. Young engineers should have continually impressed upon them the very simple fact that the answer to any question could only be as accurate as the data on which that question was founded. In his student life a young man would get a great number of problems put before him of which all the data had been simply fined down into the form of an examination question, to which a definite and exact answer could be given. After some years of this kind of work he sometimes found it more than a little difficult to realise that the questions which actually came to him in his profession never had very exact data, and, in particular, never had the exact data with which he had been familiar in an examination paper. For engineering purposes the method of working out the answer was only secondary; the answer itself was the chief thing, and they really must have that answer right when it found itself translated into steel or stone. There was more than a tendency to make technical teaching complete by covering an enormous number of subjects without considering the possibilities of the student himself in the way of receptiveness. No doubt it was very desirable that the student should know a little about as many branches of his profession as possible, but for the average young man it was impossible for him to know thoroughly more than a very small range of the ground upon which he might later on be called upon to work. It must be recognised that after he had left College he still had an enormous amount to learn, and it was very undesirable to put before him while he was at College more educational nourishment than he was really able thoroughly to digest. The best that could be hoped for, and what was really to be aimed at, was that a student should have had a thorough grounding in the general principles underlying all branches of engineering work, should have become fairly familiar with some details in a very limited section of the work, and also—perhaps above all—should have learned how to use his wits in applying his general knowledge later on to practical working at details in whatever branch was thrown in his way by circumstances. For it was little use a young man saying that he intended to be electrical, or constructive or mechanical, or what not. If he was worth his salt he would take up, when he had to earn his living, whatever work came in his way, and it was as well that he should keep this in mind from the start.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

HOLLAND.—The Board of Trade have received information to the effect that the proposed new Dutch tariff, reference to which has previously been made in these columns, has been withdrawn from the Chamber of Representatives by the Minister of Finance.

NEWFOUNDLAND.—The Government have decided that all instruments, apparatus, supplies, &c., imported and used by the Marconi Wireless Telegraph Co., of Canada, Ltd., in installing, maintaining and operating various wireless telegraph stations in Newfoundland and Labrador, shall be admitted into the Colony free of duty during the term of the agreement which has been made with the said company, to end on April 6th, 1926.

ITALY.—The Italian Customs authorities have decided that electric cord consisting of a bundle of conducting wires, each wire being covered with insulating textile thread, fastened together first by means of cotton yarn then by a strip of paper and a thin sheet of lead, and finally covered with paper and plaited cotton material, shall be dutiable on importation into Italy at the rate of 28 lire per 100 kilogs. (25 lire = £1, kilog. = 2·204 lb.).

PARAGUAY.—The Board of Trade have received a copy and translation of a circular issued by the Paraguayan Government directing that bills of lading for merchandise destined for Paraguay must be presented to the Paraguayan Consul in the country of origin in triplicate. These three copies will be legalised by the Consul who will charge $1 (4s.) for the original, and 50 cents each for the two copies. Should the shipper desire to have further copies of the bill of lading, a charge of 50 cents for each additional copy required will be made. Shippers of goods to Paraguay must also present to the Consul for legalisation the commercial invoices and certificates of origin relating to such goods. No charge is made for the legalisation of these documents, which are to be sent by the Consul, together with one copy of the bill of lading, to the Customs authorities at the port of destination.

NEW ZEALAND.—The Customs authorities have decided that a siren, electrically driven, with an electric motor forming an integral part of the same, is to be dutiable at the rate of 20 per cent. *ad valorem* if of British origin, and 30 per cent. if of foreign origin. Similar rates of duty are also fixed for step-treading of lead-filled steel for tramway cars and carriages.

SOUTH AFRICA.—A notice issued by the High Commissioner for South Africa as to the duty to be levied on catalogues sent by post from the United Kingdom to South Africa, states that in connection with the tariff of Customs duty on advertising matter, including catalogues, price lists, almanacks, calendars, labels, posters and showcards, that when any of above-named articles are sent to any person or firm in the Union of South Africa through the medium of the post office, the duty payable thereon may be prepaid

by means of stamps affixed to each separate letter, packet or parcel. Stamps of various denominations may be purchased at the office of the High Commissioner for the Union Government of South Africa, 32, Victoria Street, London, S.W. The duty on the articles enumerated above is 2d. per lb. or 25 per cent. *ad valorem*, whichever shall be the greater. In connection with the above, senders are reminded that a certain differentiation is made between catalogues of South African firms posted to persons or firms in the Union of South Africa and those of non-South African firms. A South African firm is defined as a firm having a place of business in South Africa at which stocks are held for sale. The following assessment is now in force for catalogues of non-South African firms :—

Up to 8 oz.	Free
Over 8 oz. and up to 16 oz.	2d.
Over 16 oz. and up to 24 oz.	3d.
Over 24 oz. and up to 32 oz.	4d.

and, thereafter, at the rate of 1d. for each additional 8 oz. or fraction thereof. The same scale is to apply to catalogues of South African firms, except that 1d. be charged on any catalogue weighing under 8 oz. The minimum duty payable by means of postage stamps is 1d. The stamps must be affixed to the top left-hand corner of the packets. Under the Imperial Post Office Regulations packages or parcels of over 5 lb. in weight must be sent by parcel post, in regard to which there are special regulations dealing with the question of Customs declaration of contents and value. No duty can, therefore, be prepaid by means of stamps on packages of advertising matter over 5 lb. in weight.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,435. "Improvements in band brakes particularly applicable to electrically-operated band-brakes for electric cranes and the like." Lancashire Dynamo and Motor Co., Ltd., R. S. McLeod and H. B. Whitmore. October 6th.

22,437. "Radio-telephony." F. J. Chambers. October 6th.

22,458. "Ear-caps for use in telephoning." J. C. McGowan. October 6th.

22,464. "Electric current induction apparatus." D. Suchostawer. October 6th.

22,486. "Electric apparatus for cleaning and other domestic work." E. W. Lancaster. October 6th.

22,491. "Electric intermittent automatic heat and fire register alarm." A. Ewen and T. Powell. October 6th.

22,502. "Electric self-starting devices and lighting circuits for motor-vehicles." T. W. Tattersall and J. W. Tattersall. October 6th.

22,503. "Switches for electric self-starting devices and lighting circuits for motor-vehicles." T. W. Tattersall and J. W. Tattersall. October 6th.

22,527. "Magneto-electric ignition machines for internal-combustion engines." M. Anschutz. (Convention date, December 12th, 1912, Germany.) October 6th. (Complete.)

22,531. "Electrical treatment of gold solutions and apparatus therefor." A. A. Lockwood. October 6th.

22,537. "Wireless telegraph transmitter." J. G. Balsillie. October 6th. (Complete.)

22,544. "Manufacture of resinous condensation products." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 6th.

22,549. "Electrical motors and dynamos." F. E. E. G. Schreiber. October 7th.

22,575. "Fuses or cut-outs for electric circuits." V. Hope. October 7th.

22,583. "Generation of electrical power and systems of transmission of same, with means of producing electro-mechanical power and speed regulation; the electro-mechanical propulsion of ships, railway, tramway, road, and other self-contained vehicles, electric trains, cars and the like." W. P. Durtnall and A. H. Binyon. October 7th.

22,706. "Metal-working machines with work-holding magnets." Magnet-Werk G.m.b.H. (Convention date, October 25th, 1912, Germany.) October 8th. (Complete.)

22,707. "Portable electric lamps." J. Neu. October 8th. (Complete.)

22,723. "Electric furnaces." E. Stassano. (Addition to 8,901, 1911.) October 8th. (Complete.)

22,724. "Electric furnaces." E. Stassano. October 8th. (Complete.)

22,744. "Process for the electrolytic deposition of metals from solutions containing the same." N. V. Hybinette. October 8th. (Complete.)

22,745. "Electrolytic process for extracting copper from ores." N. V. Hybinette. October 8th. (Complete.)

22,765. "Electrically-illuminated fountains." H. P. Allison. October 8th.

22,782. "Electric bells and signals." R. Nicholas. October 9th.

22,798. "Switch which contains battery for the supply of electric current." A. V. I. Bickerstaff. October 9th.

22,805. "Self-cleaning sparking-plug." W. H. Gamble. October 9th.

22,813. "Means for and method of regulating currents by static regulators." A. M. Taylor. October 9th.

22,816. "Discharge tube with incandescent cathode and enclosed vapour-forming body." Allgemeine Elektricitats Ges. Convention date, October 14th, 1912, Germany.) October 9th. (Complete.)

22,841. "Secondary batteries." A. Iconmus, filho. October 9th.

22,850. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt. Ges. (Addition to 18,498/12. Convention date, October 11th, 1912, Germany.) October 9th. (Complete.)

22,876. "Glass globe or shade holder for incandescent and other lamps." Veritys, Ltd., and A. E. Watson. October 10th.

22,886. "Constant-current dynamos." A. E. Brewerton. October 10th.

22,902. "Electrical relays such as motor-driven time relays or delay-action contact devices." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) October 10th. (Complete.)

22,926. "Electrical connection of the plug-and-socket type." E. H. Leonardt. October 10th.

22,943. "Calling and contact-relays for weak undulating currents." R. Haddan. (J. H. Reineke, Germany.) October 10th. (Complete.)

22,973. "Electrically-operated recording, measuring, signalling and other instruments." C. W. Fulton and W. E. Peters. October 11th.

23,013. "Attachment for arc lamps." H. G. Dyer and C. S. Adams. October 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,249. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,250. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,253. August 22nd.

Electrical Switch. J. G. Doran. 20,270. September 5th. (March 5th, 1913.)

Means for Ascertaining the Position of a Ship or other Moving Body either Relatively to a Pre-determined Directing System or with Reference to Another Body. A. Chessin. 21,610. September 23rd.

Power Installations. W. Morrison. 21,612. September 23rd.

Contrivance to Indicate whether an Invisible Lamp is Burning or not. J. Martin. 21,641. September 23rd.

Cooling Arrangements for Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. 21,822. September 25th.

Electric Accumulators. G. Fuller, L. Fuller and G. J. A. Fuller. 22,063. September 27th.

Electrically-heated Apparatus. F. C. R. Marks. (Landers, Frary and Clark.) 22,252. September 30th.

Electrolytic Decomposition. E. Higgins. 22,280. October 1st.

Two-rate Mechanism for Electric and other Meters. G. Wall and Ferranti, Ltd. 22,339. October 1st.

Coating and Impregnating Materials and Moulded Articles. British Thomson-Houston Co. (General Electric Co.) 22,449. October 2nd.

Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co.) 23,086. October 9th.

Crucibles for Electric Furnaces. Morgan Crucible Co. and C. W. Spiers. 24,626. October 28th.

Telephone Exchange Systems. F. R. McBerty. 25,174. November 2nd. (November 2rd, 1911.)

Railway Signalling Apparatus. H. W. Handcock, A. H. Dykes and W. Duddell. 25,383. November 5th.

Loud-speaking Telephonic Apparatus. E. A. Graham. 25,911. November 11th. (Cognate application, 13,143 of 1913.)

Telephone Transmitters. F. Gottschalk. 26,964. November 23rd.

Sheet Metal Pole-arms. M. E. Harrison. 27,155. November 26th.

Thrust Meter for Rotatory Shafts. A. Denny and F. T. Edgecombe. 27,484. November 29th.

Composition for Electrical Resistances. A. I. Grabham. 27,500. Nov. 29th.

Working Tyers, Railway Telegraph Instruments and the Like. W. Richardson and M. McCallum. 29,328. December 20th.

1913.

Electrical Apparatus for Heating Liquids. M. Ruthenburg. 47. Jan. 1st.

Electric Batteries. C. D. Galloway, Junr. 2,402. January 29th. (February 1st, 1912.)

Cord Grips for Electric Connections. B. J. Grigsby. 3,014. February 5th.

Impulse Transmitters for Automatic Telephone Plant. G. A. Betulander. 4,792. February 25th. (February 28th, 1912.)

Electrical Enunciators. British L. M. Ericsson Manufacturing Co. and A. G. Rogers. 5,626. March 6th.

Selectors especially for use with Automatic Telephone Exchanges. G. A. Betulander. 6,465. March 15th. (March 22nd, 1912.)

Electric Liquid-Heaters. E. A. Raves. 7,469. March 29th.

Manufacture of a Rubber-like Material. British Thomson-Houston Co. (General Electric Co.) 9,985. April 28th.

Magnetic Wheels for Locomotives and like Vehicles. J. O. Heinze. 10,894. May 8th.

Devices for Medical Administration of Electricity. J. Schneidrzik. 13,145. June 6th.

Temperature Alarm. J. F. J. Malone. 17,112. July 25th.

A Fishing Story.—Whilst out fishing from Langstone Harbour shore recently, Mr. G. G. H. Ogburn, of Portsmouth, noticed a lamp being washed about in the surf. He "caught" the lamp, and noticed it was an "Osram" metal-filament 50-volt, marked G.E.C. The filament appeared to be intact, and when the finder had dried and tested it, he found it all O.K. Presumably the lamp had been dropped or washed overboard from some vessel, and had been blown and knocked about till it reached the shore. At the time it was rescued it was blowing rather hard, and consequently the sea was rough. The chances that the lamp bulb would escape destruction on the shingle were feeble enough, but that the filament should be intact is still more surprising. The incident certainly forms a testimonial to the virtues of the Osram lamp.

The Effects of Ozone.—A correspondent of the *Times* recently quoted a report on the authority of the official organ of the American Medical Association, which alleged that ozone possessed no properties of hygienic value, but was rather injurious than beneficial to human beings. Replying to these statements, Mr. E. L. Joseph, managing director of Ozonair, Ltd., ascribed them to ignorance on the part of the authors, stating that the whole value of ozone, so far as its use in ventilation was concerned, lay in its powerful oxidising effect, and the amount required for the useful purification of the air was so small that no possible ill-effect could be suffered by anyone breathing such an atmosphere. He quoted the investigations of Dr. Leonard Hill, showing that the use of ozone in the proportion of one part to one million parts of air was fraught with the greatest benefit, freshening the air and rendering it invigorating.